NATIONAL OCEANOGRAPHIC PROGRAM—1969

PART 1

HEARINGS

BEFORE THE

SUBCOMMITTEE ON OCEANOGRAPHY

OF THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

NINETY-FIRST CONGRESS

FIRST SESSION

ON

A report by the Commission on Marine Science, Engineering and Resources entitled, "Our Nation and the Sea"

JANUARY 27, APRIL 29, MAY 7, 8, 13, 14, 15, 20, 21, 22, 27, 28, JUNE 3, 1969

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*Resigned effective Apr. 11, 1969. Richard N. Sharood appointed minority counsel on Apr. 14, 1969.

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NATIONAL OCEANOGRAPHIC PROGRAM—1969

MONDAY, JANUARY 27, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met in executive session at 10 a.m. in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. The meeting of the subcommittee and those other members of the full committee we invited and the staff will now come to order.

The purpose of this meeting today is to have an informal discussion between the members of the Subcommittee on Oceanography and the other members of the full committee as it was constituted in the 90th Congress with Dr. Julius A. Stratton, the distinguished chairman of the Commission on Marine Science, Engineering, and Resources, other commissioners who are here with him, and members of his staff, on the subject of the final report of the Commission entitled "Our Nation and the Sea."

I hope you gentlemen got an opportunity to read this report and study it in depth.

For the record, it will be recalled that after over 7 years of comprehensive and careful study by the appropriate committees in both Houses in the Congress, Public Law 89–454 was enacted into law with the approval of the President on June 17, 1966.

That act contained a declaration of policy of the United States to develop, encourage, and maintain a coordinated, comprehensive and long-range national program in marine science for the benefit of mankind, to assist in protection of health and property, enhancement of commerce, transportation and national security, rehabilitation of our commercial fisheries, and increased utilization of these and other resources.

Key provisions of the act established in the Executive Office of the President the National Council on Marine Resources and Engineering Development to provide advice and assistance to the President in meeting his responsibilities in regard to carrying out the national policy and programs. The function of the Council was to participate in the planning and conduct of coordinated Federal programs of a current and ongoing nature.

The Council is a Cabinet-level body under the chairmanship of the Vice President.

In addition to the Council, the act also provided for the establishment of a Commission on Marine Science, Engineering, and Resources,

composed of 15 members appointed by the President, including individuals drawn from Federal and State governments, industry, universities, laboratories, and other institutions engaged in marine scientific or technological pursuits. The act provided that not more than five members of the Commission shall be from the Federal Government. In addition, provision was made for four advisory members of the Senate and the House of Representatives.

The functions of the Commission were to be complementary to those of the Council and with responsibility to make a comprehensive investigation and study of all aspects of marine science and to recommend an overall plan for an adequate national oceanographic program that will meet present and future national needs.

As originally enacted, the act provided that the Commission submit to the President, via the Council, and to the Congress, not later than 18 months after its establishment, a final report of its findings and recommendations.

It further provided that the Commission would cease to exist 30 days after submission of its final report, and that the Council would cease to exist 120 days after the submission of the Commission's report.

In recognition of the enormity of the job that had to be done, the Congress, by Public Law 90–242, extended the life of the Commission for 6 months and the life of the Council until June 30, 1969.

The Marine Science Commission was established in January of 1967, after selection by the President of an exceedingly able membership, under the distinguished chairmanship of Dr. Stratton.

The Commission has worked with great concentration and energy for the past 2 years and has met the requirement of the statute by submitting its report to the President and to the Congress on January 9.

We in Congress, gentlemen, can do no less than to meet as promptly as possible, and with all of the concentration necessary, our responsibilities to review the Commission's voluminous report and its numerous and far-reaching recommendations. And then we should take such action as we believe is necessary to implement those recommendations.

Because of the complexities, and perhaps even potentially controversial aspects of the Commission's report, the Chair felt that it was desirable that members of the subcommittee and other ranking members of the committee should meet as soon as possible to have this informal executive meeting and discussion with Dr. Stratton and his colleagues.

The Chair has asked Dr. Stratton to be prepared this morning to give us highlights of the Commission's report and to be available for questioning by the members.

Hopefully, after the meeting we are having today, we will have a better idea of how we should proceed, and establish a schedule of public hearings.

Before asking Dr. Stratton to proceed, I want to take this opportunity to compliment him, his member colleagues, and his very excellent staff for the tremendous work that they have presented to us.

I might say to you gentlemen who have been members of the subcommittee since the enactment into law in June of 1966, that all of us, who have been privileged to be close to the work of the Commission, especially Mr. Mosher and myself, have reached the point where we

can say in candor and frankness to all of you that I have never known any more dedicated work on the part of any group in delving in depth on this subject. If you read this report you will see how much in depth they have gone.

Certainly these gentlemen have done a magnificent job, led by a person who could not have been a finer selection, and whatever the action of the 91st or 92d or 93d Congress would be, I think this report will go down in history as one of the great efforts made by private citizens in cooperation with the Government in finding a solution to this problem.

I think it would be appropriate at this time, to insert into the record, a biography of each of the members of the Commission. If there is no objection, so ordered.

(The material referred to follows:)

BIOGRAPHIES OF MEMBERS, COMMISSION ON MARINE SCIENCE, ENGINEERING, AND RESOURCES

JULIUS A. STRATTON

Julius A. Stratton assumed the Chairmanship of the Board of the Ford Foundation in 1966 upon his retirement as President of the Massachusetts Institute of Technology, an institution with which he had been continuously associated since his undergraduate days. Born in Seattle on May 18, 1901, he spent one year at the University of Washington and then transferred to MIT, graduating with the Class of 1923. He studied abroad in 1923 and 1924 at the Universities of Grenoble and Toulouse after which he returned to MIT where he received his Master's degree in 1925. He was awarded the degree of Doctor of Science in Mathematical Physics by the Eidgenossische Technische Hochschule of Zurich in 1927 and followed this with study at the Universities of Munich and Leipzig on a traveling fellowship from MIT.

He joined the MIT faculty in the Department of Electrical Engineering in 1928 and subsequently became Professor of Physics, Director of the Research Laboratory of Electronics, Provost, Vice President, Chancellor, and, in 1959, President. He is now a Life Member of the MIT Corporation.

Dr. Stratton is a director of the Standard Oil Company of New Jersey and the Westinghouse Electric Corporation, and a trustee of Pine Manor Junior College and Vassar College.

He is a member of the National Academy of Sciences, the National Academy of Engineering, the American Philosophical Society, and a Fellow of the American Academy of Arts and Sciences, the Institute of Electrical and Electronics Engineers, and the American Physical Society.

He received the Medal for Merit from the Secretary of War in 1946, the Certificate of Award of the United States Navy (1957), the Medal of Honor of the Institute of Radio Engineers (1957), and the Faraday Medal of the British Institute of Electrical Engineers (1961).

RICHARD A. GEYER

Dr. Geyer is presently Head of the Department of Oceanography at Texas A&M University where he has been since 1966. Previously, from 1963–1966, he was Technical Director for Oceanography for Texas Instruments, Inc. From 1959–1963, he was a manager of Gravity and Magnetic Department of Texas Instruments, and from 1954–1959, he was Chief Geophysicist for the Gravity Department, Geophysics Services, Inc., of Texas Instruments. From 1945–1954, he was associated with Humble Oil and Refining Company, first as Senior Research Geophysicist and then Head of the Oceanographic Section from 1949–1954.

During World War II, Dr. Geyer served as Physicist in Charge of the Degaussing Range for the US Navy, Bureau of Ordnance, in Newport, Rhode Island, and as Senior Field Instructor at Woods Hole Oceanographic Institution at Woods Hole, Massachusetts. Before the war, from 1939–1942, he was an instructor at Princeton, and from 1938–1942, he did research in geophysics and geology for the Standard Oil Company in New Jersey.

Dr. Geyer was born on October 27, 1914, in New York City. In 1937, he received his BS from New York University; in 1940, he received his MS, also from New York University; and in 1950, he received his MA, and in 1951, his PhD from Princeton University.

Dr. Geyer is presently a member of the National Academy of Sciences Committee on Oceanography—Ocean Wide Surveys Panel and a member of the Board of the American Society for Oceanography of the National Oceanographic Society and of the Marine Technology Society. He was a consultant with the US Coast and Geodetic Survey and was formerly an editor of Geophysics.

DAVID A. ADAMS

Dr. Adams is currently a member of the National Council on Marine Resources and Engineering Development Staff. He served as Commissioner of the North Carolina Division of Commercial and Sports Fisheries from 1963–1968. Before that he was curator of the North Carolina State Museum from 1962–1963, chief Park Naturalist of the North Carolina Division of State Parks from 1957–1959, and a waterfowl biologist for the North Carolina Wildlife Resources Commission in 1957.

Dr. Adams was born in Lakewood, Ohio, on November 26, 1931. He attended North Carolina State College where he received his BS in Wildlife Conservation and Management in 1953, his MS in Wildlife Management in 1957, and his PhD in Plant Ecology in 1962. He is the author of numerous professional publications and a member of several professional and honorary societies.

Currently, Dr. Adams is a member of the Ecological Society of America, the American Institute of Biological Sciences, and the American Fisheries Society. He was formerly Chairman of the South Atlantic Section of the Atlantic States Marine Fisheries Commission and Vice Chairman of the Atlantic States Marine Fisheries Commission.

CARL A. AUERBACH

Professor Auerbach has been a Professor of Law since 1947, serving at the University of Minnesota Law School since 1961, and before that at the University of Wisconsin Law School. In 1965, 1966 and 1967, he served as a visiting Professor at Columbia Law School, Utah Law School and Iowa Law School, respectively.

Professor Auerbach received his BA degree in 1935 from Long Island University and his LLB from Harvard University Law School in 1938. Upon graduation from law school, he took a position as attorney in the US Department of Labor, where he served until 1940 when he moved to the Office of Price Administration as Assistant General Counsel. He served with the US Army in the OSS from 1943 until 1946 when he returned to the government as General Counsel in the Office of Price Administration and Associate General Counsel in the Office of the Economic Stabilization.

Professor Auerbach is the author of numerous legal articles and is the co-author of two books: "The Legal Process—An Introduction to Decision-Making by Judicial, Legislative, Executive and Administrative Agencies," and "The Federal Regulation of Transportation—Materials Illustrating Problems of Public Utility Control." He was also the recipient of a Fulbright Advanced Research Award in 1953, and from 1958–1959, he was a Fellow at the Center for Advanced Study in the Behavioral Sciences. He is also a member of the Division of Behavioral Sciences of the National Research Council.

Professor Auerbach has been a consultant to the Agency for International Development and the Staff Director to the Committee on International Organization and Procedure of the Administrative Conference of the United States.

CHARLES F. BAIRD

Mr. Baird joined the International Nickel Co. of Canada, Ltd., as vice president, finance, in February 1969 and is also vice president, finance, and director of the company's U.S. subsidiary, the International Nickel Co., Inc.

For over 3 years prior to that time Mr. Baird served as a member of the U.S. Navy Secretariat. He was nominated by President Johnson as Assistant Secretary of the Navy (Financial Management). He served in that capacity until August 1, 1967, when he became the Under Secretary of the Navy as well as a member of the Commission on Marine Science, Engineering, and Resources.

Prior to his Government service, Mr. Baird had been an executive with Standard Oil Co., (New Jersey) and its affiliated companies for over 17 years. Starting his

career as a financial analyst, he served in various executive capacities including Deputy European Financial Representative in London, financial director and member of the executive committee of Esso Standard, S.A. Francaise, and assistant treasurer of the parent company.

Mr. Baird served as an officer in the Marine Corps in World War II and during the Korean war.

Mr. Baird was born in Southampton, N.Y., September 4, 1922. He is a graduate of Middlebury College where he majored in economics. He studied at New York University Graduate School of Business Administration and in 1960 completed the advanced management program of the Harvard University Graduate School of Business Administration.

He is a trustee of Bucknell University, a member of the Council of Financial Executives of the National Industrial Conference Board, the Council of Foreign Relations, the Atlantic Council of the United States and the American Academy of Political and Social Science.

JACOB BLAUSTEIN

Mr. Jacob Blaustein, of Baltimore, Maryland, has been long active in public life. President Eisenhower appointed him a US Delegate to the United Nations. President Truman appointed him a member of the Mobilization Policy Board during the Korean War. President Roosevelt appointed him Consultant to the American Delegation to the United Nations Organization Conference in San Francisco in 1945. President Kennedy appointed him a Presidential Representative on the Board of Governors of United Service Organizations (USO), and as Consultant to the State Department on International Business Problems, to both of which he has been reappointed under President Johnson's Administration. President Johnson also appointed him a member of the Commission on Marine Science, Engineering and Resources.

With his father, the late Louis Blaustein, he was cofounder of the American Oil Company (AMOCO). He is a Director of the Standard Oil Company (Indiana) and of a number of other business corporations, including the Union Trust Company of Maryland, and the United States Fidelity and Guaranty Company.

During World War II, Mr. Blaustein was acting Chairman of the Marketing Committee of the United States Petroleum Administration. He is a member of the National Petroleum Council of the United States Department of the Interior. He is also a member of the Board of American Petroleum Institute.

Mr. Blaustein is a member of the Presidium, and Senior Vice President, of the Conference on Material Claims Against Germany which negotiated the agreements with the Federal Republic of Germany for the rehabilitation of the surviving victims of Nazi persecution, and which is handling the distribution of proceeds.

He was National President, is now Honorary President, of the American Jewish Committee. In 1946, he was Chairman of the AJC Delegation at the Paris Peace Conference.

He is active in many philanthropic organizations; and is on the Boards of several educational and several scientific institutions, including the Maryland Academy of Sciences and the Baltimore Museum of Art. He is a member of the Board of Governors of the Hebrew University in Jerusalem, and is a member of Columbia University's Advisory Council, School of International Relations.

Mr. Blaustein was awarded honorary Doctorates of Humane Letters by his alma mater, Lehigh University, and by the Hebrew Union College; also honorary Doctorates of Laws by The Maryland Institute, College of Art; and an honorary Doctorate of Political Science by Wilberforce University, LL. D by each Morgan State College, Jewish Theological Seminary, and PMC Colleges.

Mr. Blaustein has received a number of other awards, such as the Award for Citizenship by The Albert Einstein College of Medicine; the Distinguished Service Award by the University of Maryland: the Richard Gottheil Medal by the Zeta Beta Tau Fraternity; the American Liberties Medallion; and the Achievement Award from the Society for Advancement of Management. He has been created a Knight of Malta and awarded the Maltese Cross.

Mr. Blaustein was appointed by the King of Sweden to the Board of Trustees of the Dag Hammarskjold International Foundation; and is a Trustee of the Eleanor Roosevelt Memorial Foundation; a Trustee of the Lafayette Fellowship Foundation; and a Director of the Adlai Stevenson Institute of International Affairs.

JAMES A. CRUTCHFIELD

Dr. Crutchfield is presently Professor of Economics at the University of Washington, with which he has been associated since 1949. Dr. Crutchfield is well known in the field of fishery economics and water resources and has participated in several national and international conferences on these and other subjects. He has also been the recipient of numerous research grants to study various aspects of the fishing industry.

In addition to his academic duties, Dr. Crutchfield has held several advisory positions. Among these are the positions of: Chief of Mission, Food and Agriculture Organization of the United Nations, Nigeria; Member of the Advisory Committee on Fisheries Research of the National Academy of Sciences; Chief of Mission of the UN Special Fund Mission to Ghana; and many others.

Born on September 9, 1918, in New London, Connecticut, Dr. Crutchfield received his BA degree in 1940 and his MA degree in 1954 from the University of California. He is the author of numerous professional articles and publications.

FRANK C. DI LUZIO

Mr. Di Luzio is presently vice president of E.G. & G., Inc., and president of its subsidiary, Reynolds Electrical & Engineering Co., Inc., with offices located in Las Vegas, Nev. He served as a member of the President's Commission on Marine Sciences, Engineering, and Resources, and is presently a member of the National Water Commission and the NASA Aerospace Safety Review Panel. He served as Assistant Secretary of the Interior for Water Pollution Control from July 1966 to January 1968. Previous to his papointment as Assistant Secretary, he was Director of the Office of Saline Water in the Department of the Interior. His first Government position was as engineer with the Bureau of Reclamation on the Grand Coulee Dam project in 1938. In 1944 he was assigned to the Manhattan Engineering District, U.S. Army Corps of Engineers, and from 1944–57 he held various positions with the Atomic Energy Commission. From 1957–61 he was Deputy Manager of the Atomic Energy Commission's Operations Office in Albuquerque, N. Mex., from which position he moved to various executive offices with Fairbanks, Morse & Co., serving as general manager of the firm's Albuquerque Research Center, vice president of engineering for the Beloit Division, and vice president and director of the Hydraulic and Special Products Division. From 1963–65 he served as staff director of the U.S. Senate Committee on Aeronautical and Space Sciences.

Mr. Di Luzio, a U.S. citizen, was born in Rome, Italy, on September 2, 1913. He studied civil engineering at the Cleveland Institute of Technology and the Case Institute of Technology and received his B.S. from Fenn College in 1938. In 1957 he attended the Harvard Graduate School of Business Administration.

LEON JAWORSKI

Mr. Jaworski is presently senior partner with the law firm of Fulbright, Crooker, Freeman, Bates and Jaworski with whom he has been associated since 1931. He is also Director and Chairman of the executive committee of the Bank of the Southwest, Houston, Texas; a Director of Anderson, Clayton and Company; a Director of Gulf Publishing and Gulf Printing Company; a Director of Benjamin Franklin Savings Association; and a Director of the Pan American Sulphur Company.

Mr. Jaworski has held many positions in the public service. From 1962–1965, he was Special Assistant to the US Attorney General and from 1963–1965, he was Special Counsel to the Attorney General of Texas. He is a member of the National Citizens Committee for Community Relations, a member of the President's Commission on Law Enforcement and the Administration of Justice, Chairman of the Governor's Committee on Public School Education, a past Chairman of the Houston-Harris County Economic Opportunity Organization, and a U.S. member of the Permanent Court of Arbitration, The Hague. He was named recently by President Johnson to serve as arbitrator of the International Center for Settlement of Investment Disputes.

Mr. Jaworski is a member of numerous professional associations and is a past President of the State Bar of Texas, The American College of Trial Lawyers, the Houston Bar Association, and the Texas Civil Judicial Council. He is the author of several professional articles and a book, "After Fifteen Years," a behind-the-scenes account of the Nazi war crimes trials.

Born in Waco, Texas, on September 19, 1905, Mr. Jaworski received his Bachelor of Laws degree from Baylor University in 1925 and his Master of Laws degree from George Washington University in 1926. He is a member of several civic and charitable organizations and has received numerous civic awards.

JOHN A. KNAUSS

John A. Knauss (B.S. in meteorology, Massachusetts Institute of Technology, 1943; M.A. in physics, University of Michigan, 1949; Ph. D., Scripps Institution of Oceanography, University of California, 1959.) Military service: U.S. Navy, July 1943–October 1946; USNR(R) 1966; Oceanographer in the Office of Naval Research, 1949–51; member of the staff of Scripps Institution of Oceanography, 1951–61; professor of oceanography and dean of the Graduate School of Oceanography since 1962 and provost for marine affairs as of January 1, 1969, University of Rhode Island; president of the Oceanographic Section of the American Geophysical Union 1965–68. He has been a member of several advisory groups to the U.S. Government concerning problems in oceanography, including Committee on Mine Warfare, the National Academy of Sciences, National Research Council; Chairman, Panel on Oceanography of the Advisory Committee to the U.S. Coast and Geodetic Survey, the National Academy of Sciences; member of the Panel on Oceanwide Surveys of the National Academy of Sciences Committee on Oceanography; and advisory panels to the Atomic Energy Commission and U.S. Weather Bureau. He was a member of President's Commission on Marine Science, Engineering, and Resources, and is currently a member of Advisory Committee for Environmental Sciences, National Science Foundation, and member of National Academy of Sciences Committee on Oceanography. Has participated in approximately 16 oceanographic expeditions, scientific leader of 10, and has published extensively on problems relating to ocean circulation. Dean Knauss was born in Detroit, Mich., on September 1, 1925; is married to the former Marilyn Mattson of Winthrop, Mass. They have two sons and reside in Saunderstown, R.I.

JOHN H. PERRY, JR.

John H. Perry, Jr., is President and Chairman of Perry Publications, Inc., a Florida corporation which operates twenty-eight newspapers in Florida; All Florida magazine, a Sunday supplement; Palm Beach Life magazine, The Freeport News on Grand Bahama Island in the Bahamas; The Statewide All Florida News Service; and numerous commercial printing plants in Florida and Atlanta, Ga.

Mr. Perry pioneered in the use of computers for production of newspaper typesetting and ad composition. He also has developed the Perry Photo-Composer for automatic newspaper page makeup. He designed and developed the first four-color web wrap-around rotary press. Also, he invented and developed the Perry Cubmarine, a small manned submarine, and other underwater devices. Cubmarines are produced by Perry Submarine Builders, Inc., of which Mr. Perry is President.

He is a Director of the Inter-American Press Association; Cowles Communications, Inc.; the Caribbean Conservation Corporation; and is a National Associate of the Boys' Clubs of America.

He is a Trustee of the International Oceanographic Foundation and a member of the Ocean Sciences and Engineering Council of Palm Beach (Florida) County, Inc., as well as a member of the Advisory Council on Naval Affairs in the Sixth Naval District.

Mr. Perry was born in Seattle, Washington, on January 2, 1917; graduated from Hotchkiss in 1935; Yale in 1939; and attended the Harvard School of Business Administration. In World War II, he served as a pilot in the Anti-Submarine and Air Transport Command and is now a licensed commercial pilot. Mr. Perry is the author of a book entitled, "The National Dividend."

TAYLOR A. PRYOR

Mr. Pryor, a resident of Hawaii, is the founder of the Makapuu Oceanic Center where a marine exhibit, a marine science institute, and an ocean engineering testing facility are operated under his direction. President of The Oceanic Foundation, Mr. Pryor is also a Director of the National Oceanographic Association, Sea Life, Inc., C. Brewer Corporation, and the Hawaiian Manufacturers' Association. He served as a member of the Senate of the State of Hawaii from

1965 until his appointment to the Commission on Marine Science, Engineering and Resources in 1967. He serves on the Governor's Advisory Committee for Science and Technology and is a member of the Science Advisory Committee to the New England Aquarium.

Born in Connecticut in 1931, Mr. Pryor received his BA from Cornell and his graduate training in Marine Ecology from the University of Hawaii. He was a Naval aviator, USMCR, from 1954 to 1957. A receipient of the Honolulu Chamber of Commerce Progress Award of 1964 and the Hawaii J. C. TOYM Award of 1966. Mr. Pryor is the author of several publications on marine life and marine conservation.

GEORGE E. REEDY

Mr. Reedy is currently President of the Struthers Research and Development Corporation, Washington, D.C. He is also Vice-President for Planning and a Member of the Board of Directors of Struthers Wells Corporation. Prior to these positions Mr. Reedy had a long career in politics and government. He has served as Press Secretary and Special Assistant to President Johnson. Previously, he served as Staff Director of the Senate Democratic Policy Committee from 1953 until 1961. Prior to his association with the Policy Committee, Mr. Reedy was Staff Consultant to the Senate Armed Services Preparedness Subcommittee for two years. Except for the period from 1942 to 1946, Mr. Reedy was a congressional correspondent for United Press. During World War II, Mr. Reedy served in the mid-Pacific as a Captain in the USAF.

Mr. Reedy was born in East Chicago, Indiana, on August 5, 1917. He received a BA in Sociology from the University of Chicago in 1938.

GEORGE H. SULLIVAN

Dr. Sullivan is an executive of the Northrop Corporation, Beverly Hills, California. As director of Life Sciences for Northrop he has the responsibility for planning, organizing and implementing all the research and development programs in which man or other lower life forms are an important element. Many of these programs are directly related to the use of the oceans. Significant examples are: systems engineering support to the US Navy Man-in-the-Sea project, biomedical problems relating to survival of SCUBA swimmers, antibiotics from the ocean, and mass culture of marine algae for human consumption.

As an electrical engineer assigned to the Navy Department's Nuclear Reactor Electrical Control Branch between 1955 and 1957, Dr. Sullivan was responsible for the design, development and operation of the electrical, steam and reactor control systems for the first, and subsequent, nuclear submarines. Previously, he had served as a naval line officer, gaining extensive submarine experience aboard the USS WAHOO.

Dr. Sullivan graduated from the US Naval Academy in 1948 with a Bachelor of Science degree, and received his Doctor of Medicine degree from Georgetown University.

ROBERT M. WHITE

Dr. Robert M. White became the first Administrator of the Environmental Science Services Administration (ESSA) when the new Department of Commerce agency was established in July 1965.

Before his appointment as ESSA Administrator by President Johnson, Dr. White had been Chief of the Weather Bureau, US Department of Commerce, since October 1963. He has also served since early 1964 as Federal Coordinator for Meteorology, with the responsibility for coordinating and planning Federal weather services and supporting research.

Born in Boston in 1923, Dr. White received a BA degree in geology from Harvard University in 1944. While attending Harvard, he worked as a weather observer at the Blue Hill Observatory. During World War II, Dr. White was a Captain in the US Air Force with duties in both weather forecasting and instruction. Continuing his studies in meteorology at Massachusetts Institute of Technology, he earned his Master's degree in 1949 and his Doctorate in 1950.

From 1952 to 1958, Dr. White was Chief of the Large Scale Processes Branch of the Atmospheric Analysis Laboratory at the Geophysics Research Directorate, Air Force Cambridge Research Center. During this time, he directed a program of studies on the dynamics of general atmospheric circulation, long-range forecasting, and statistical weather prediction. In 1958, he became Chief of the Meteorological Development Laboratory at the Cambridge Research Center, providing technical leadership of an extensive research program in weather

prediction, atmospheric dynamics, applied climatology, and meteorology and meteorological equipment. During the first half of 1959, he was a research associate at Massachusetts Institute of Technology, studying problems of stratospheric meteorology.

He joined the Travelers Insurance Companies at Hartford, Connecticut, in July 1959, as head of the Travelers Weather Research Center. Later, he was Associate Director of the Research Department of the Travelers Insurance Companies. When the Travelers Research Center, Inc., was established in 1960, Dr. White became its first President. He served in this position until his appointment by President Kennedy as Chief of the US Weather Bureau. Dr. White is a member of numerous professional and honorary societies.

Mr. LENNON. Mr. Rogers?

Mr. ROGERS. I want to say, too, as I am sure all members of this committee do, concur with the feelings expressed by the chairman with regard to the fine work the Commission has done. It has been exceptional. I think the report is excellent. It has been well received so far. I think you can take great satisfaction in the fact that this report that you have devoted so much time and energy to will in effect lay the groundwork and the plan for the oceanographic effort of this Nation.

I commend you and express my personal thanks.

Mr. LENNON. I yield to the gentleman from Ohio.

Mr. MOSHER. Of course, I concur in what you have said. I personally have felt it a great privilege to be closely associated with the Commission during its studies. My own personal reaction to the report is completely favorable and affirmative. The general public response has been very fine and has shown very favorable interest.

The only criticism I have heard is that the report is somewhat modest in its expenditure proposals. There is some feeling you might have set even higher goals. However, that can take care of itself during the next decade.

I am very anxious for this Congress to get to work on implementing some of the ideas in the proposal.

Mr. LENNON. Dr. Stratton, if you will proceed along the lines just mentioned. I might say, Dr. Stratton has been confined with the Hong Kong flu for a week or so, and is still not completely well.

Dr. Stratton may yield to members of his Commission on other aspects of the report.

Would you first introduce members of the Commission to other members of the committee?

STATEMENT OF DR. JULIUS A. STRATTON, FORMER CHAIRMAN, COMMISSION ON MARINE SCIENCE, ENGINEERING AND RESOURCES

Dr. STRATTON. I will start with Dr. David Adams, Dr. Robert White, Dr. John Knauss, our executive director Dr. Samuel Lawrence, Mr. George Reedy, Mr. John Perry, and Dr. George Sullivan.

Let me begin, gentlemen, by saying in behalf of the Commission how very much we appreciate the remarks which you have expressed. I can only verify that we have given this task everything we have. It has been the most totally engaging and encompassing thing that I have ever attempted. We have driven hard. Many of you have heard me say repeatedly here and there over the past 2 years that this has been a working commission. I think this is true.

What comes out of this result will be the product of everybody who has participated. Behind it lies the panels of all these individuals, the groups they have brought together, literally hundreds of people in universities and Government who have been brought in.

We recognize very well and very clearly that there are issues and recommendations here that are subject to discussion. Much of this is in an area which cannot be taken as black and white. There are some areas where there will be controversy inevitably. We have tried to make clear what the issues are, and in each case we think it is better to take a position than just to be cautious. We have given our best judgments.

I think this report is replete with recommendations for action, for legislation, and it is our hope that we will have accomplished what I know to have been your real purpose in enacting that public law; namely, that out of this would come a substantial advance in the whole field with which we are deeply concerned.

The final report, as you have indicated, Mr. Chairman, is completed. It was delivered formally to the President and to the Congress. On the 9th of February the Commission officially ceases to exist.

But the critical test, as you have indicated, in this whole effort of nearly 2 years now, lies ahead of us. The only valid measure of success will be the extent to which this array of findings and recommendations leads to positive, constructive action, action destined to increase by an entire order of magnitude the benefits to be derived by the people of our country from the manifold uses of the sea.

As you indicated, this will be somewhat of an informal discussion to see how we carry on, what this really means, where we should go.

I would suggest the following procedure. We have had prepared a statement; it highlights the report of the Commission and is an effort to bring together the main points. There is so much there that this has been no easy task.

But it takes chapter by chapter and points up what is involved.

The general structure of the report does not coincide entirely, as you are aware, with that of the original panel structure and organization which had to do with science, technology, resources, environment, education, business incentives for industry, and the international aspects. We have taken the results of the panel studies, and we are anxious to have these in your hands as quickly as possible, and over the past 2 months we have brought all this together and fused it into the report which is before you. There we begin with a discussion of the capabilities. What are the means that are essential if we are to do this job?

Then we talk about the areas of most urgent importance, that of the coastal zones. There is a very extensive discussion of the resources, living and nonliving resources in chapter 4, and it is followed by a discussion of the global environment, problems with which Dr. White is so familiar, the need for services and what they should be, and then culminating in the most critical and perhaps most crucial chapter—how do we organize and what should we do in order to get on with this from an organizational point of view? Lastly, there is our best effort to give some estimate of cost.

It is an unusual situation for a Commission, Mr. Mosher, to come in with a report and be told we didn't ask for enough. We can remedy that more easily than we can a number of other matters. We can come to that later.

I would like to suggest that perhaps this statement on the highlights be entered into the record. If it is agreeable to you, Mr. Chairman, I will call successively on a number of my associates here to read or to comment with regard to their interpretation of each of these chapters—what is in it and what is really important. That might be the basis of questions you would ask so we can get a discussion.

One statement here. The people I call on are not personally identified with those particular chapters. Again this is a fusion here of different people. I do not want to hold them as singly accountable for what is here. We take common responsibility for this report.

If this is agreeable to you, Mr. Lennon, I would like to call first on John Perry to talk a little bit about what is needed to be done to develop our national capabilities and why this is important.

Mr. LENNON. Do I understand it is your desire that these highlights be entered in the record at this time and the remarks of other members of the Commission follow?

Dr. STRATTON. I should like to make that request.

Mr. LENNON. Without objection that shall be done.

(The report referred to follows:)

HIGHLIGHTS OF THE REPORT OF THE COMMISSION ON MARINE SCIENCE, ENGINEERING, AND RESOURCES

Like the oceans themselves, the Nation's marine interests are vast, complex, and not susceptible to simplicity of treatment. A plan for national action is needed to assure the orderly development of our uses of the sea in a manner which will advance the nation's security, contribute to its economic growth, assure that it can meet increasing demands for food and raw materials, protect its position and influence in the world community, and preserve and improve the quality of the environment in which our people live. The plan must provide for determined attack on immediate problems concurrently with initiation of a long-range program to develop the knowledge, technology, and a framework of laws and institutions to lay the foundation for efficient and productive marine activities in the years ahead.

The Commission report begins with an introductory statement of the Nation's stake in the uses of the sea and a summary of major recommendations. The five chapters which follow treat primary areas of national emphasis. Since a strong, solid base of science and technology is the common denominator for accomplishment in every area of marine interest, actions necessary to advance our technical capability are presented at the outset in Chapter 2. Then follow in order chapters on the protection and management of the coastal zones and estuaries; the development of living and nonliving resources of the sea; the exploration and monitoring of the total global environment; and the technical services necessary to operate at sea. Chapter 7 brings together the Commission's proposals for strengthening Federal organization through formation of a National Oceanic and Atmospheric Agency (NOAA), and the report concludes with an estimate of costs.

The remainder of this statement identifies the Commission's major findings and recommendations in order to provide an overview of the total proposed program.

Improving national capability

The Commission's concern with science and technology appears throughout its report—in relation to coastal management, fresh water restoration, resource development, deep sea exploration, environmental monitoring, and a host of marine services. Although each of these areas presents special requirements, they all draw on a common pool of knowledge regarding the sea and on a common reservoir of fundamental engineering skill.

Arrangements for the support of marine science are well established, but must be improved to provide means for attacking large-scale problems and greater continuity of funding. In contrast, there is now no strong civil marine technology program; initiation of such a program is needed to increase our access to the sea and its resources, lower the costs of marine operations while increasing their reliability and safety, and provide the knowledge needed to make intelligent decisions regarding large future public and private investments.

To provide a more effective attack on large-scale scientific problems, the Commission proposes that a small group of institutions, including the present leaders in ocean research, be designated as University-National Laboratories and equipped to undertake major marine tasks of global or regional nature. Coastal Laboratories also should be established in association with universities in each of the coastal states and aided in developing adequate facilities and continuing programs in coastal engineering and ecological research. Institutional support for these two categories of laboratories must be supplemented by research grants to individual scientists engaged in valuable basic research both in these laboratories and elsewhere throughout the nation in order to maintain highly desirable diversity in the total enterprise.

A national program to advance fundamental marine technology should emphasize activities basic to a wide variety of potential applications and be supported by NOAA through grants and contracts to industry and universities. Many fields of technology must be significantly advanced before the Nation can achieve the goals proposed by the Commission: to be able to perform productive work for sustained periods at depths to 2,000 feet and to have useful access to depths of 20,000 feet. They include materials technology, power sources, external machinery, tools, navigation systems, instruments, mooring and anchoring systems, life support systems, and improved data on environmental effects and biomedical phenomena.

National Projects are proposed to focus the effort on specific areas of need and opportunity, to impart a sense of priority, to involve actively a variety of groups, to provide the facilities needed to test the economic and technical feasibility of new systems, and to put technology at the service of scientific research and resource exploration. Six such projects, listed in Attachment 1, are specifically recommended in the report; others are identified for further consideration.

The U.S. Navy has a key role in advancing national capability and should work in tandem with the National Oceanic and Atmospheric Agency. As Navy mission requirements permit, provision should be made for other agencies to use Navy facilities on a reimbursable basis. Opportunities to spin off civil applications from defense projects should be identified. However, civil and military interests and priorities will not always coincide, and a national program cannot rest solely on Department of Defense-supported efforts.

The Commission anticipates that the proposed national effort will generate its own personnel, principally through transfer from other specialties but also through increased enrollment in marine education and training programs. Expanded support through NSF and NOAA will be needed, but the Commission's principal recommendation is that NOAA be assigned responsibility to analyze trends in manpower requirements in all marine fields, project future requirements, and coordinate Federal agency marine education and training activities.

The Coastal Zone

The coastal zone presents both some of the Nation's most urgent environmental problems and most immediate and tangible opportunities for improvement. The Commission considers this zone to embrace the territorial sea, Great Lakes, tidal areas, and those port and harbor facilities, recreational areas, and commerical and industrial sites which are dependent on the seas and Great Lakes. Coastal counties include roughly half of the Nation's people and its most rapidly growing urban areas. It is the area in which industry, trade, recreation and conservation interests, waste disposal, and potentially aquaculture all press most sharply on the limited resources of our environment.

The Commission finds the key need in the coastal zone to be a management system which will permit conscious and informed choices among development alternatives and which will provide for proper planning. The Federal Government can help in establishing such a system, but the primary responsibility lies with the States.

The Commission proposes enactment of a Coastal Management Act to establish policy guidelines, authorize matching grants-in-aid to States to develop and Implement a management plan, specify Federal responsibilities for review of State plans, and provide a means for coordinating Federal and State activities and for planning the development and use of areas lying beyond State jurisdiction. Although the Act should allow the States considerable latitude in shaping their coastal programs, it is essential that the State Authorities be able to exercise impartial judgment in weighing problems arising from conflicting use and be equipped with planning and regulatory authority (including in typical cases authority for zoning and eminent domain) adequate to their task.

Effective coastal management will need to be supported by substantially increased research, survey, and monitoring programs organized at both the Federal and State levels. Two particularly urgent, specific needs are for delineation of State seashore and seaward boundaries and for a comprehensive analysis of future port and waterway needs. The Commission recommends the formation of a National Seashore Boundary Commission to meet the former need and the initiation of a major study under the lead of the Department of Transportation to meet the latter.

Coastal management must be concerned both with conservation and development. Improved scientific and technical knowledge is needed to reach an optimum balance; and in the future such knowledge will be increasingly critical for evaluating proposals for major modification in coastal lands and waters. Studies also are needed of means to move major facilities farther offshore in order to relieve pressures on the fragile tidal zone, and provision must be made for expanding recreation opportunities and assuring continued public access to the sea. Simplified leasing procedures are recommended to permit use of inshore waters in a variety of new ways, including the practice of aquaculture, and provision for such activities should be made in coastal development plans.

Pollution constitutes a major obstacle to effective use of coastal waters and severely threatens their future. The Commission has recognized that it is not practical to tackle coastal pollution in isolation from the other aspects of the overall waste management problem. Nevertheless, there are certain needs for action which are unique to the marine environment. In particular, it is important that the AEC and Corps of Engineers be empowered to consider pollution effects of activities which fall within their licensing authorities.

The deterioration of the Great Lakes presents a special problem and the Commission places a high priority on its recommended program to test methods for lake restoration.

Marine resources

At present most activities to tap the resources of the sea are concentrated in areas close to shore. But new technology is extending minerals-development operations outward onto the continental shelves and slopes and is yielding new techniques to harvest and use the living resources of the sea. The prospect that man may be able to gain new wealth from the sea has fired much of the recent interest in marine affairs.

The Commission's appraisal of the economic potential of marine resources has been tempered by an appreciation of the institutional and technical obstacles which must be surmounted to make significant advances. But even hard estimates indicate great possibilities for the future in—

Continuing expansion of already large and profitable offshore oil and gas operations.

Rehabilitating and redirecting our commercial fisheries to improve economic returns and to develop large latent resources off our coasts.

Developing the new field of aquaculture.

Mining placer minerals from the continental shelf and, within a somewhat longer time span, recovering mineral deposits from the deep sea floor.

Economic uses of the sea are primarily a responsibility of the private sector. There is, nevertheless, a large role for government to assist. Public policy should be directed to: (1) assuring that the United States not be confronted with a critical shortage of any raw material and (2) advancing economic efficiency in the development of both marine and non-marine resources. Further, the Commission recognized that the U.S. interest in marine resources must be viewed in terms of world needs and capabilities.

A. MARINE FISHERIES

Our Nation has a strong interest in advancing development of the ocean's food resources. The race between population and food supply has potentially explosive consequences and every avenue must be employed to control it. Further, fishing is important to the U.S. both in terms of providing Americans with a more varied diet and of providing the basis for profitable industrial activity.

About 66 percent of the world's fisheries harvest, and 72 percent of the catch by U.S. boats, is taken in coastal waters. However, revolutionary developments in fishing technology are causing rapid growth in the exploitation of high seas fisheries, giving urgency to improving arrangements for international fishery management and to setting up cooperative programs to identify and assess potential yields of new stocks. The Commission has proposed a number of steps to

strengthen the institutional frameworks for both high seas and domestic fisheries which are aimed at increasing economic return from heavily utilized species and at providing incentives to expand catches of under utilized species.

The welter of conflicting, overlapping, and restrictive laws and regulations applying to fishing operations in U.S. coastal waters is a major impediment to the expansion of our domestic industry. In view of the discouraging lack of coordination among state programs, the Commission concludes that Federal leadership and guidance, and when necessary, regulatory power must be asserted. The Commission has also recommended removal of present legal restrictions on the use of foreign-built vessels by U.S. fishermen in U.S. domestic fisheries and an intensive effort through the proposed National Oceanic and Atmospheric Agency (BCF) to analyze each major fishery off U.S. coasts and to develop integrated research, survey, and technical programs to exploit those fisheries where opportunities for expansion exist.

B. AQUACULTURE

Compared with activities elsewhere in the world, the practice of aquaculture in in the U.S. is at a low level but is showing signs of rapid growth. Realizing the potential of aquaculture will require overcoming certain legal and institutional constraints as well as advancing scientific and technical knowledge to permit production at competitive costs. The Commission concluded that aquatic culture offers a valuable supplement to harvesting of natural stocks and that the National Oceanic and Atmospheric Agency (BCF) should be given an explicit mission to advance its practice.

C. DRUGS

The Commission also recognized the public interest in evaluating the potential of marine life as a source of new and useful medicinal materials and has recommended formation of a new program within the National Institutes of Health to effect a methodical inventory and evaluation.

D. MINERAL RESOURCES

1. *Petroleum.*—For the foreseeable future, oil and gas will be the most valuable minerals the nation can obtain from the sea. Currently, offshore sources account for about 16 percent of total world oil recovery and are expected to provide a third of total world production within 10 years. The search for new reserves is stimulated by forecasts of tripled consumption within 20 years and by political instability in some oil producing nations.

Leasing and regulatory policies pertaining to U.S. outer continental shelf oil reserves must be geared to a rate of development which reflects all aspects of the national interest. The Commission urges a new assessment of the adequacy of the Nation's oil reserves to provide a sound basis for shaping incentives to explore and test the potential of new subsea fields. Further, in scheduling its lease sales the Federal Government must give adequate consideration to industry's need to plan its exploration and development programs in an orderly and effective manner.

2. *Natural Gas.*—With growing demand and with reserves declining in reference to production, it is important to encourage exploration and development of new sources of natural gas. The maximum price which transmission companies can pay at the wellhead for gas is regulated by the Federal Power Commission, and some adjustment might be desirable to reflect adequately the greater cost of offshore production. Similarly, the transmission industry's research and development activities are influenced by the FPC's accounting regulations, and it is important that such regulations be clear and consistent with the transmission industry's legitimate needs.

3. *Hard Minerals.*—The marine mining industry is in its infancy. Excluding shorebased operations, sulphur wells, recovery of chemicals from sea water, and dredging for sand, gravel, and oyster shells, total worldwide production of hard minerals from the seabed is estimated to total only $50 million currently. However, world demand for many key minerals is expected to double by 1985 and triple by 2000, and it is essential that the United States encourage an increasing rate of discovery to ensure an adequate and dependable supply. The long lead time which will be required to define and appraise mineral resources and to develop the technology for their recovery requires orderly action now to establish the basis for future mining activity. The primary needs are for preinvestment geological surveys, development of fundamental technology relevant to minerals exploration and exploitation, and greater flexibility in the leasing provisions for the Outer Continental Shelf Lands Act of 1953.

4. *Fresh Water.*—Brackish and salt water are being converted to fresh water in many parts of the world and possibilities may exist for tapping ground waters in coastal strata. The Federal Government's ongoing desalination research and development program reflects a close and effective partnership among Federal, State, and local governments and the academic community, and the Commission recommends its continuation with increased emphasis on the possibilities of very large-scale applications, smaller plants for such purposes as tapping brackish water supplies for inland communities, and systems permitting re-use of waste waters.

The Department of the Interior is responsible for fostering the development and use of the Nation's minerals, including those of the outer continental shelf. It should continue to administer the outer continental shelf leasing programs and exercise primary responsibility for deciding whether the national interest warrants specific action to encourage development of seabed resources. However, conduct of offshore surveys and development of fundamental technology for marine operations are programs which should be assigned to the National Oceanic and Atmospheric Agency. NOAA will need to work closely with the Geological Survey and the Bureau of Mines in these tasks.

The Commission, through its Panel on Marine Industry and Investment, has given special attention to the circumstances and needs of marine industries. In general, the Commission has found that capital has not been lacking to finance industrial ocean projects and that industry neither desires nor needs direct Government subsidies. Rather, to encourage private investment enterprise Government policy should be directed to providing the research, exploration, fundamental technology, and services necessary to expanded operations at sea and should seek to introduce a framework of laws and regulatory policies that will allow greater predictability in business planning and thereby increase confidence and investment activity. An important responsibility of the proposed new agency will be to work on a sustained basis with other agencies of Government, in consultation with the private sector, to achieve these objectives.

The marine resource industries have a common interest in the clarification of marine boundaries and jurisdictions. But the matters at stake in securing international agreements regarding the geographic extent of national jurisdiction over seabed resources and arrangements for exploring and exploiting resources in the areas beyond involve far-ranging and difficult questions of national policy which require consideration also of the Nation's military and foreign policy interests. The Commission recommends that the United States seize the opportunity for leadership which the present situation demands and has proposed a legal-political framework for overcoming present uncertainties. Its proposal anticipates redefinition of the "continental shelf" to fix its seaward limits at the 200 meter isobath or 50 nautical miles from the baseline for measuring the breadth of the territorial sea, whichever gives greater area; the creation of an "intermediate zone" to encompass the bed and subsoil of the deep sea in the band lying seaward of the continental shelf as redefined to the 2,500 meter isobath or points 100 miles from the baseline; the creation of an International Registry Authority to register claims by nations to explore and exploit the mineral resources of the seabed and subsoil of the deep seas including the intermediate zones; and the creation of an International Fund to receive payments from registering nations to be expended for such purposes as marine scientific activity, resource development, and aiding developing countries.

The global environment

The Nation's interest in the seas, the land beneath, and the atmosphere above require that it attain the capability to observe, describe, understand, and predict oceanic and related atmospheric and geophysical processes on a global scale. The Nation is engaged or must be prepared to engage in operations in all of the world's oceans in increasing depths and in increasingly hostile environments. Furthermore, the oceans, atmosphere, and solid earth are interacting parts of a single, incredible complex system. In many ways, the oceans are the dominant factor in this total environment. Man's activities are fast approaching a stage when we can influence, modify, and perhaps even control the total planetary system.

A strategy for advancing our understanding of the global environment, both as a scientific problem and to meet practical operating requirements, will require a balanced effort in research, exploration, technology, and by the latter part of the coming decade, the development of a global monitoring and prediction system. New institutional arrangements will be needed both domestically and interna-

tionally. Near-term improvements in sea and air observation and prediction programs also are possible and are recommended.

The Commission concludes that the proposal for an International Decade of Ocean Exploration offers an excellent vehicle to bring the necessary international collaboration to an expanded effort in research, surveys, and exploration of the global oceans. Execution of U.S. participation in the Decade should be focused in NOAA and the University-National Laboratories with assistance by industry.

The key to study of the deep oceans lies in improved technology. The Commission concludes that there is no single approach, manned or unmanned, to the task. Extensive efforts are merited to increase the access of free-swimming divers in the sea, to extend the range and endurance of deep-diving manned submersibles, and improve observing instruments of all kinds.

The development of a system for monitoring and predicting the state of the oceans and the atmosphere is critical to all that the Nation would do in the seas. Observations are now technology limited; predictions are seriously limited by incomplete understanding. Thus the design of system components must be accompanied by strong scientific programs to increase understanding of current systems, sea-air interactions, and scales of motions.

Such studies, coupled with continuous monitoring of sea-air phenomena, will provide the necessary basis for coping with planned and unplanned environmental modification. A central point of responsibility within Government is essential both to plan the necessary global monitoring and prediction system and to assess the impact of man on nature.

Technical and operating services

A great variety of technical services to support marine operations are being furnished by the Federal Government with a minimum of fanfare. The prevailing efficiency with which these services are provided minimizes public clamor for bold new programs and tends to conceal the vital functions being performed. Yet it is evident that sharp expansion in some services and reorientation of others will be necessary to meet the challenges and capitalize on the opportunities presented by rapidly developing technology.

A number of Federal agencies now provide services, and many inter-relationships exist among their programs. Thus, improved navigational positioning will facilitate preparation of more accurate maps and charts; these in turn will contribute to marine safety. Accurate instruments, built to meet agreed performance standards, are necessary to all marine activities. Useful data banks require that measurements be inter-comparable. Centering the majority of such service activities in a single agency, as proposed by the Commission, will importantly assist the Government to meet the increasingly demanding requirements of the Nation's expanded activities at sea.

Organizing for action

As an essential first step in undertaking a national ocean effort, the Federal Government must achieve a capability for conducting its own expanded activities and for providing imaginative support and leadership to the broad marine community. The Commission has concluded that existing organization is inadequate to these purposes. While there are strong elements, which should be retained and strengthened, many Federal marine activities relate only marginally to their parent agencies. This results in a scattering of inadequately supported programs that consequently lack impact and complicate efforts to improve planning and coordination.

The Commission believes that its proposed program can be achieved only by creating a major civil agency with adequate authority and resources. Such an agency must be of a size and scope commensurate with the magnitude, importance and complexity of the problems it seeks to solve, the services it seeks to render, and its potential contribution to the well-being of society. It can then be an effective claimant for the funds needed and give leadership and coherence to the total national effort.

The major functions of the National Oceanic and Atmospheric Agency proposed by the Commission would be to—

Explore the marine frontier and its interrelationships with the atmosphere.
Define its resources.
Advance capabilities for its use.
Provide supporting services including weather and ocean forecasts.
Minimize conflicts over uses of the marine environment.

Coordinate scientific and technical requirements and recommendations in support of foreign policy objectives.

Serve marine industry and the marine interest of the American people.

NOAA would be composed of organizational elements concerned primarily with scientific, technical and service functions necessary for expanding the planned use of the sea and its resources and for monitoring, predicting, and potentially modifying the air and sea environments. It should include the Coast Guard, the Environmental Science Services Administration, the Bureau of Commercial Fisheries (augmented by the marine and anadromous fisheries functions of the Bureau of Sport Fisheries and Wildlife), the National Sea Grant Program, the U.S. Lake Survey, and the National Oceanographic Data Center. Important new functions would also be vested in the agency. Transfer of the Antarctic program and the National Center for Atmospheric Research to NOAA might be accomplished later.

The size and scope of the program recommended by the Commission require that NOAA, at least initially, be an independent agency reporting directly to the President. In getting a major and diverse effort underway, the case for independent status is compelling. An independent agency can bring freshness of outlook and provide freedom of action, and its public visibility would draw public interest and support. Moreover, no existing department has sufficiently broad responsibilities to embrace the full scope of functions proposed for NOAA. However, future basic reorganizations of the executive branch might permit transfer of NOAA to a favorable location.

A truly national effort in the oceans requires organizational arrangements for obtaining information and advice from the broad marine community. The Commission has therefore recommended establishment of a Presidentially appointed National Advisory Committee for the Oceans (NACO) to advise the head of NOAA in carrying out his functions and to report periodically to the President and the Congress on progress in achieving national objectives. Members would be drawn from outside the Federal Government and be broadly representative of the Nation's marine and atmospheric interests; Federal agency representatives would participate as observers in the work of the committee.

The Commission's organizational proposals would permit the President to delegate planning and coordination responsibilities to an operating agency which has a strong base of technical expertise. However, until decisions are reached on its organization plan, the Commission believes it important to continue the National Council on Marine Resources and Engineering Development.

Estimated costs

To mount the national effort recommended by the Commission will require a build-up over the years of qualified personnel and suitable facilities. The Commission feels strongly that the build-up should take place at a rate which can be sustained.

The funding problem for the marine program is quite different from that which accompanied the launching of the space program. The National Aeronautics and Space Administration was entrusted with the organization of a new program which had very few antecedents and which was placed on a time table requiring a very rapid build-up of scientific and engineering effort. The objective of the Commission's proposal, in contrast, is to emphasize and rationalize programs which, for the most part, are already in existence and which are already returning benefits to our people.

Programs recommended by the Commission are estimated to involve an annual expenditure growing by 1980 to roughly $1 billion per year over and above current program levels. This approximate doubling of present efforts could be achieved by maintaining a 7 to 10 per cent rate of growth over the 10-year period. The details of the Commission's cost estimates are tabulated in Attachment 2.

Expanding expenditures for civil marine programs will need to be accompanied by increasing support for military programs. Because the Navy now has an active program and extensive capital facilities, funding for such activities may not need to increase in percentage terms as rapidly as on the civil side, where the current level of activity is lower in reference to current needs. But it is obvious that the Defense Department's requirements for marine and atmospheric science, technology, and services will have to keep pace with the increasing sophistication of military systems operating on, under, and over the seas.

Developing cost estimates was among the most difficult aspects of the Commission's analysis. In spite of the uncertainties attendant on these estimates,

they nevertheless are a measure of the kind of commitment which the Commission feels the Nation must make. Yet they do not tell the full story. There are some stakes, such as a livable environment or the security of the Nation, which are priceless. Some of the least expensive recommendations, such as the establishment of the State Coastal Zone Authorities and the new international convention on the seabed, are among the most important ones. Benefits to the Nation will come not only from additional programs but also from the redirection of some current expenditures into more productive uses.

The Commission's cost estimates must be viewed in this light. They simply represent, as do the other parts of this report, our best judgment of how to respond to the needs and opportunities which relate our Nation to the sea.

Attachment 1

National projects recommended by the Commission

Continental Shelf Laboratories Project.—A continuing project to develop and construct both fixed and portable laboratories in the 200- to 2,000-foot depth range and with capacities to house 15 to 150 men depending upon mission needs.

Submerged Continental Shelf Nuclear Plant Project.—An experimental plant, which might be constructed initially in conjunction with a Fixed Continental Shelf Laboratory, to test the feasibility of using submerged nuclear power sources for development of continental shelf resources and of underwater siting of future large generating stations to provide power to coastal cities.

Great Lakes Restoration Feasibility Test.—A continuing project to develop alternative methods for restoring the quality of fresh water lakes, including pilot operations to test restoration techniques in small lakes for subsequent application to the Great Lakes.

Pilot Buoy Network Project.—A program to develop and test a system for continuous observation and recording of marine and atmospheric phenomena in a limited region, comprising buoys, anchoring systems, sensor packages, and logistics support ships.

Long Endurance Exploration Submersibles.—A submersible for civil exploration missions to 20,000-foot depths, incorporating advanced materials and sensors.

Test Facilities and Ranges.—A series of pressure test facilities, "in situ" ranges and biomedical chambers to assist in the development of reliable systems and equipments and to determine the medium limits of man operating as a free diver.

Attachment 2

Detail of estimated costs

The following tables show two different perspectives on the estimated costs of the Commission's recommendations. Table 1 shows the expenditures classified by major program area; Table 2 presents the same expenditures recategorized by the type of activity or function being performed.

The cost estimates are necessarily subject to a number of definitions, assumptions, and limitations which are spelled out in full in Chapter 8 of the Commission's report. Among the more important to note are that—

All amounts are for the incremental costs, over and above present levels, for implementing Commission recommendations.

The estimates are limited to programs addressed by the Commission and therefore do not represent the total cost of a comprehensive ocean program. On the other hand, there has been no attempt to project what portion of the programs recommended by the Commission might reasonably be expected to be financed from amounts already within agency plans.

Estimates have been provided for Defense Department programs only for selected activities which relate intimately to civil functions.

No estimates have been made of the investments which might be required of State and local governments and industry to meet their responsibilities under the Commission's recommended plan.

All amounts are shown in constant 1969 dollars.

TABLE 1.—COSTS BY PROGRAM AREA

[Incremental costs in millions]

Program area	Average annual costs		10-year total costs
	1971–75	1976–80	
All Commission recommendations	$652	$948	$8,000
Improving the national capability	152	191	1,715
Laboratory facilities	32	14	230
National projects	50	70	600
Fundamental technology	60	90	750
Education and training	7	11	90
Scientific and technical information	3	6	45
Managing the coastal zone	86	121	1,035
Management and planning	10	10	100
Land acquisition	11	11	110
Scientific and engineering studies	50	80	650
National project	15	20	175
Resources	191	290	2,405
Living resources programs	62	88	750
Nonliving resources programs	39	66	525
National projects	60	86	730
Fundamental technology	30	50	400
Global environment	179	272	2,255
Research and exploration	81	162	1,215
Global monitoring system	48	15	315
Environmental modification program	20	45	325
Fundamental technology	30	50	400
Supporting services	44	74	590
Mapping and charting	16	20	180
Marine safety and enforcement	8	12	100
Data services	5	7	60
Development of service systems	15	35	250

TABLE 2.—COSTS BY ACTIVITY

[Incremental costs in millions]

Activity	Average annual costs		10-year total costs
	1971–75	1976–80	
All Commission recommendations	$652	$948	$8,000
Management and operations	62	70	660
Services	36	41	385
Land acquisition	11	11	110
Planning	15	18	165
Research and education	142	226	1,840
Laboratory facilities and operations	71	101	860
Research programs	64	114	890
Education and training	7	11	90
Specific technology programs	124	182	1,530
Coastal engineering	20	40	300
Resource development	45	68	565
Research and monitoring equipment	44	39	415
Service systems development	15	35	250
National projects	160	215	1,875
Test facilities and ranges	43	57	500
Lake restoration project	15	20	175
Continental Shelf laboratories	40	60	500
Continental Shelf nuclear plant	20	26	230
20,000-foot exploration submersibles	20	37	285
Pilot buoy network	15	2	85
Feasibility studies of future projects	7	13	100
Fundamental technology	130	210	1,700
Capability	60	90	750
Resources	40	70	550
Global environment	30	50	400
Mapping, charting, and surveying	34	45	395

ATTACHMENT 3

ACTION REQUIRED TO IMPLEMENT COMMISSION RECOMMENDATIONS

I. Legislation will be required to:

Establish NOAA and delineate its functions, powers and duties.

Establish a National Advisory Committee on the Oceans.

Continue the National Council for Marine Science and Engineering Development as a statutory body.

Establish a new grant-in-aid program to encourage formation of state Coastal Zone Authorities.

Emplower NOAA (BCF) under certain stipulated conditions to assume regulatory responsibility for endangered coastal fisheries.

Empower NOAA (Sea Grant Program) to make grants to aid in acquisition of ships and facilities.

Authorize Federal guarantees of State bonds for acquiring wetlands and assistance in meeting amortization and interest costs.

Establish a National Seashore Boundaries Commission.

Authorize the Corps of Engineers to deny construction permits to preserve conservation, recreation or aesthetic values or to prevent water pollution (if courts hold that such authority not now available).

Enable the AEC to consider environmental effects of nuclear power projects prior to granting licenses.

Remove restrictions of the use of foreign-built fishing vessels by American fishermen.

Rescind the requirement in the Fishermen's Protective Act that the President reduce foreign aid payments to any country by the total of unpaid U.S. claims against it for seizing U.S. fishing vessels.

Establish a National Institute of Marine Medicine and Pharmacology.

Empower the Secretary of the Interior to waive the competitive bidding requirements of the Outer Continental Shelf Lands Act in awarding rights for development of hard minerals.

Compensate private enterprise for loss of investment or expenses occasioned by any new international framework that redefines the Continental Shelf.

Require industrial firms to obtain the permission of the Secretary of the Interior to engage in mineral resources exploration or exploitation in any subsea area beyond the 200-meter isobath.

Recodify laws on vessel safety standards, extend certification to civil submersibles, provide safety standards for commercial fishing vessels, and empower the Coast Guard to establish minimum safety standards in the manufacture of pleasure boats.

Center responsibility for Federal marine law enforcement in the Coast Guard.

Ratify the optional Protocol to the 1958 Geneva Conventions on the Law of the Sea.

II. Legislation appears desirable, although is not necessarily required, to implement Commission recommendations to:

Designate the Department of Transportation as the lead agency for a major interagency study of the nation's port and waterway system.

Encourage greater provision of public access and recreational opportunities in Federally funded or assisted waterfront and beach development projects.

Require a biennial report to the Congress by the Secretary of the Interior regarding progress in pollution abatement.

Establish a national commission on waste management.

Set forth the purposes and major components of a national ocean program including such new elements as:

Establishing increased understanding of the planetary oceans as a major national goal.

Establishing goals to occupy the bed and subsoil of U.S. territorial sea, to utilize shelf and slope to 2,000 feet and to achieve capability to explore to 20,000 feet by 1980.

Authorizing the designation of University-National Laboratories and Coastal Zone Laboratories and providing for their continuing institutional support.

Initiating a comprehensive program to advance fundamental marine technology.

Providing for the conduct of National Marine Projects.

Authorizing a program to advance the practice of aquaculture.
Authorizing bathymetric, geophysical, and geological surveys of the Continental shelf and slope adjacent to U.S. coasts.
Authorizing a national environmental monitoring and prediction system.
Authorizing a program to explore beneficial modification of environmental conditions and effects of inadvertent interference.
Authorizing a marine instrument testing and calibration program.
Centering responsibility for coordinating weather modification activities in NOAA.

Mr. LENNON. Would you indicate the areas to which you will address your remarks if they are included in the highlights?

STATEMENT OF JOHN H. PERRY, JR., PRESIDENT, PERRY PUBLICATIONS, INC.

Mr. PERRY. I will deal with improving the national capability, starting at page 2.

The Commission's concern with science and technology appears throughout its report—in relation to coastal management, fresh water restoration, resource development, deep-sea exploration, environmental monitoring, and a host of marine services. Although each of these areas presents special requirements, they all draw on a common pool of knowledge regarding the sea and on a common reservoir of fundamental engineering skill.

Arrangements for the support of marine science are well established, but must be improved to provide means for attacking large-scale problems and greater continuity of funding. In contrast, there is now no strong civil marine technology program; initiation of such a program is needed to increase our access to the sea and its resources, lower the costs of marine operations while increasing their reliability and safety, and provide the knowledge needed to make intelligent decisions regarding large future public and private investments.

To provide a more effective attack on large-scale scientific problems, the Commission proposes that a small group of institutions, including the present leaders in ocean research, be designated as university-national laboratories and equipped to undertake major marine tasks of global or regional nature. Coastal laboratories also should be established in association with universities in each of the Coastal States and aided in developing adequate facilities and continuing programs in coastal engineering and ecological research. Institutional support for these two categories of laboratories must be supplemented by research grants to individual scientists engaged in valuable basic research both in these laboratories and elsewhere throughout the Nation in order to maintain highly desirable diversity in the total enterprise.

A national program to advance fundamental marine technology should emphasize activities basic to a wide variety of potential applications and be supported by NOAA through grants and contracts to industry and universities. Many fields of technology must be significantly advanced before the Nation can achieve the goals proposed by the Commission: To be able to perform productive work for sustained periods at depths to 2,000 feet and to have useful access to depths of 20,000 feet. The 2,000-foot depth was proposed because it covers the 2,000-foot area. Also, we feel man can work to that depth with the present promise of technology.

If man is able to liquid breathe at some future time, he may go deeper outside of habitat beyond the 2,000 feet.

The 20,000-foot depth was chosen, because it represents 90 percent of the ocean. The rest goes into areas very much deeper but very much limited in square area, such as the deepest point being 36,000 feet. So we have at the 20,000-foot work level some 98 percent of the ocean.

Another goal we propose to meet is the development of materials technology. They include materials technology, power sources, external machinery, tools, navigation systems, instruments, mooring and anchoring systems, life support systems, and improved data on biomedical phenomena.

National projects are proposed to focus the effort on specific areas of need and opportunity, to impart a sense of priority, to involve actively a variety of groups, to provide the facilities needed to test the economic and technical feasibility of new systems, and to put technology at the service of scientific research and resource exploration. Six such projects, listed in attachment 1, are specifically recommended in the report; others are identified for further consideration.

The U.S. Navy has a key role in advancing national capability and should work in tandem with the National Oceanic and Atmospheric Agency. As Navy mission requirements permit, provision should be made for other agencies to use Navy facilities on a reimbursable basis. Opportunities to spin off civil applications from defense projects should be identified. However, civil and military interests and priorities will not always coincide, and a national program cannot rest solely on Department of Defense-supported efforts. We feel it is a good idea to have a competitive situation in the field of technology. At the present time the Navy is the only one with technology. I think we get more out of the Navy but we get more effort in the direction of cutting costs by having the civilian technology department.

The Commission anticipates that the proposed national effort will generate its own personnel, principally through transfer from other specialties but also through increased enrollment in marine education and training programs. Expanded support through NSF and NOAA will be needed, but the Commission's principal recommendation is that NOAA be assigned responsibility to analyze trends in manpower requirements in all marine fields, project future requirements, and coordinate Federal agency marine education and training activities.

Mr. LENNON. Let us proceed with the next presentation, Dr. Stratton.

Dr. STRATTON. If I may turn next to the coastal zone and ask Dr. John Knauss to discuss the highlights in that area.

STATEMENT OF DR. JOHN A. KNAUSS, DEAN, GRADUATE SCHOOL OF OCEANOGRAPHY

Dr. KNAUSS. I am John Knauss and will discuss the coastal zone, which starts at the bottom of page 5 of the report handed to you.

We consider the coastal zone to embrace the territorial sea, Great Lakes, tidal areas, and those port and harbor facilities, recreational areas, and commercial and industrial sites which are dependent on the seas and Great Lakes. Coastal counties include roughly half of the Nation's people and its most rapidly growing urban areas. It is the

area in which industry, trade, recreation and conservation interests, waste disposal, and potentially aquaculture all press most sharply on the limited resources of our environment.

The thing we try to stress in the panel report is that these are rapidly increasing pressures in this area created by the problems of conflicting use, and that many of the problems are extending seaward.

The Commission finds the key need in the coastal zone to be a management system which will permit conscious and informed choices among development alternatives and which will provide for proper planning. The Federal Government can help in establishing such a system, but the primary responsibility lies with the States.

The Commission proposes enactment of a Coastal Management Act to establish policy guidelines, authorize matching grants-in-aid to States to develop and implement a management plan, specify Federal responsibilities for review of State plans, and provide a means for coordinating Federal and State activities and for planning the development and use of areas lying beyond State jurisdiction. Although the act should allow the States considerable latitude in shaping their coastal programs, it is essential that the State authorities be able to exercise impartial judgment in weighing problems arising from conflicting use and be equipped with planning and regulatory authority (including in typical cases authority for zoning and eminent domain) adequate to their task.

This concept of zoning is really a new idea. What we mean by impartial is that these coastal management authorities should not be all conservation or all industrial development. We must find ways to have all interests represented.

Effective coastal management will need to be supported by substantially increased research, survey, and monitoring programs organized at both the Federal and State levels. Two particularly urgent, specific needs are for delineation of State seashore and seaward boundaries and for a comprehensive analysis of future port and waterway needs. The Commission recommends the formation of a National Seashore Boundary Commission to meet the former need and the initiation of a major study under the lead of the Department of Transportation to meet the latter.

Coastal management must be concerned both with conservation and development. Improved scientific and technical knowledge is needed to reach an optimum balance; and in the future such knowledge will be increasingly critical for evaluating proposals for major modification in coastal lands and waters. Studies also are needed of means to move major facilities farther offshore in order to relieve pressures on the fragile tidal zone, and provision must be made for expanding recreation opportunities and assuring continued public access to the sea. Simplified leasing procedures are recommended to permit use of inshore waters in a variety of new ways, including the practice of aquaculture, and provision for such activities should be made in coastal development plans.

Pollution constitutes a major obstacle to effective use of coastal waters and severly threatens their future. The Commission has recognized that it is not practical to tackle coastal pollution in isolation from the other aspects of the overall waste management problem. Nevertheless, there are certain needs for action which are unique to the marine environment. In particular, it is important that the AEC

and Corps of Engineers be empowered to consider pollution effects of activities which fall within their licensing authorities.

The deterioration of the Great Lakes presents a special problem and the Commission places a high priority on its recommended program to test methods for lake restoration.

Dr. STRATTON. The whole area of marine resources, of course, is one of the broadest and most important and really the heart of much of this problem. It is represented by chapter 4 and about a third of the entire report.

Mr. LENNON. Let me make an inquiry before you start. Some of our coastal States have organized Marine Science Councils. This is at the State level.

A number of the coastal States have State ports authorities. Most of our States have some sort of a State commission for water, stream and air pollution.

Have copies of this report been sent to those State agencies representing State port authorities, State commissions for water pollution and air pollution, and so on?

Dr. KNAUSS. They will be, sir. I think until the Government Printing Office can come out with the final report there were not enough copies as of this time.

Mr. LENNON. Who will have the responsibility to send to the proper executive directors of the agencies I mentioned copies of this report?

Dr. KNAUSS. We have made some attempt to get the names of these groups in the various States. I am sure the list is not complete.

We will make an initial effort.

Mr. LENNON. I do hope that will be done because I can foresee that members of this committee will be requested to get copies and we will have inquiries as to what is this we are reading about, where can we find out about it, and so on.

I hope that will be done, gentlemen.

Dr. STRATTON. Mr. Chairman, you put your finger on an important problem. I indicated we formally came to a conclusion on the ninth of February. We are taking what steps we can to assure that there is enough followup so that this can happen.

Dr. LAWRENCE. I can only amplify Dr. Knauss' response. We do plan to send copies of the printed report as soon as the Government Printing Office has completed its work to States and individuals working on panels.

Each State has in the Governor's office a Federal-State relations coordinator. We have these names. I thought I would first send a letter along with about 20 copies of the report to that coordinator and ask him to distribute this report to the various agencies.

Mr. LENNON. Thank you, gentlemen. I am glad to have your assurance that that will be done.

Dr. STRATTON. Dr. David Adams, a report on marine resources.

STATEMENT OF DR. DAVID A. ADAMS, SENIOR STAFF, MARINE SCIENCES COUNCIL

Dr. ADAMS. Marine resources. At present most activities to tap the resources of the sea are concentrated in areas close to shore. But new technology is extending minerals-development operations outward onto the continental shelves and slopes and is yielding new

techniques to harvest and use the living resources of the sea. The prospect that man may soon be able to gain new wealth from the sea has fired much of the recent interest in marine affairs.

The Commission's appraisal of the economic potential of marine resources has been tempered by an appreciation of the institutional and technical obstacles which must be surmounted to make significant advances. But even hard estimates indicate great possibilities for the future in continuing expansion of already large and profitable offshore oil and gas operations.

Rehabilitating and redirecting our commercial fisheries to improve economic returns and to develop large latent resources off our coasts.

Developing the new field of aquaculture.

Mining placer minerals from the Continental Shelf and, within a somewhat longer time span, recovering mineral deposits from the deep sea floor.

Economic uses of the sea are primarily a responsibility of the private sector. There is, nevertheless, a large role for Government to assist. Public policy should be directed to: (1) assuring that the United States not be confronted with a critical shortage of any raw material and (2) advancing economic efficiency in the development of both marine and nonmarine resources. Further, the Commission recognized that the U.S. interest in marine resources must be viewed in terms of world needs and capabilities.

A. Marine fisheries: Our Nation has a strong interest in advancing development of the ocean's food resources. The race between population and food supply has potentially explosive consequences and every avenue must be employed to control it. Further, fishing is important to the United States both in terms of providing Americans with a more varied diet and of providing the basis for profitable industrial activity.

About 66 percent of the world's fisheries harvest, and 72 percent of the catch by U.S. boats, is taken in coastal waters. However, revolutionary developments in fishing technology are causing rapid growth in the exploitation of high seas fisheries, giving urgency to improving arrangements for international fishery management and to setting up cooperative programs to identify and assess potential yields of new stocks. The Commission has proposed a number of steps to strengthen the institutional frameworks for both high seas and domestic fisheries which are aimed at increasing economic return from heavily utilized species and at providing incentives to expand catches of under utilized species.

The welter of conflicting overlapping, and restrictive laws and regulations applying to fishing operations in U.S. coastal waters is a major impediment to the expansion of our domestic industry. In view of the discouraging lack of coordination among State programs, the Commission concludes that Federal leadership and guidance, and when necessary, regulatory power must be asserted. The Commission has also recommended removal of present legal restrictions on the use of foreign-built vessels by U.S. fishermen in U.S. domestic fisheries and an intensive effort through the proposed National Oceanic and Atmospheric Agency (BCF) to analyze each major fishery off U.S. coasts and to develop integrated research, survey, and technical programs to exploit those fisheries where opportunities for expansion exist.

B. Aquaculture: Compared with activities elsewhere in the world, the practice of aquaculture in the United States is at a low level but is showing signs of rapid growth. Realizing the potential of aquaculture will require overcoming certain legal and institutional constraints as well as advancing scientific and technical knowledge to permit production at competitive costs. The Commission concluded that aquatic culture offers a valuable supplement to harvesting of natural stocks and that the National Oceanic and Atmospheric Agency (BCF) should be given an explicit mission to advance its practice.

C. Drugs: The Commission also recognized the public interest in evaluating the potential of marine life as a source of new and useful medicinal materials and has recommended formation of a new program within the National Institutes of Health to effect a methodical inventory and evaluation.

D. Mineral resources:

1. Petroleum: For the foreseeable future, oil and gas will be the most valuable minerals the Nation can obtain from the sea. Currently, offshore sources account for about 16 percent of total world oil recovery and are expected to provide a third of total world production within 10 years. The search for new reserves is stimulated by forecasts of tripled consumption within 20 years and by political instability in some oil-producing nations.

Leasing and regulatory policies pertaining to U.S. Outer Continental Shelf oil reserves must be geared to a rate of development which reflects all aspects of the national interest. The Commission urges a new assessment of the adequacy of the Nation's oil reserves to provide a sound basis for shaping incentives to explore and test the potential of new subsea fields. Further, in scheduling its lease sales the Federal Government must give adequate consideration to industry's need to plan its exploration and development programs in an orderly and effective manner.

2. Natural gas: With growing demand and with reserves declining in reference to production, it is important to encourage exploration and development of new sources of natural gas. The maximum price which transmission companies can pay at the wellhead for gas is regulated by the Federal Power Commission, and some adjustment might be desirable to reflect adequately the greater cost of offshore production. Similarly, the transmission industry's research and development activities are influenced by the FPC's accounting regulations, and it is important that such regulations be clear and consistent with the transmission industry's legitimate needs.

3. Hard minerals: The marine mining industry is in its infancy. Excluding shorebased operations, sulphur wells, recovery of chemicals from sea water, and dredging for sand, gravel, and oyster shells, total worldwide production of hard minerals from the seabed is estimated to total only $50 million currently. However, world demand for many key minerals is expected to double by 1985 and triple by 2000, and it is essential that the United States encourage an increasing rate of discovery to insure an adequate and dependable supply. The long leadtime which will be required to define and appraise mineral resources and to develop the technology for their recovery requires orderly action now to establish the basis for future mining activity. The primary needs are for preinvestment geological surveys, develop-

ment of fundamental technology relevant to minerals exploration and exploitation and greater flexibility in the leasing provisions for the Outer Continental Shelf Lands Act of 1953.

4. Fresh water: Brackish and salt water are being converted to fresh water in many parts of the world and possibilities may exist for tapping ground waters in coastal strata. The Federal Government's ongoing desalination research and development program reflects a close and effective partnership among Federal, State, and local governments and the academic community, and the Commission recommends its continuation with increased emphasis on the possibilities of very large-scale applications, smaller plants for such purposes as tapping brackish water supplies for inland communities, and systems permitting reuse of waste waters.

The Department of the Interior is responsible for fostering the development and use of the Nation's minerals, including those of the Outer Continental Shelf. It should continue to administer the Outer Continental Shelf leasing programs and exercise primary responsibility for deciding whether the national interest warrants specific action to encourage development of seabed resources. However, conduct of offshore surveys and development of fundamental technology for marine operations are programs which should be assigned to the National Oceanic and Atmospheric Agency. NOAA will need to work closely with the Geological Survey and the Bureau of Mines in these tasks.

The Commission, though its Panel on Marine Industry and Investment, has given special attention to the circumstances and needs of marine industries. In general, the Commission has found that capital has not been lacking to finance industrial ocean projects and that industry neither desires nor needs direct Government subsidies. Rather, to encourage private investment enterprise Government policy should be directed to providing the research, exploration, fundamental technology, and services necessary to expanded operations at sea and should seek to introduce a framework of laws and regulatory policies that will allow greater predictability in business planning and thereby increase confidence and investment activity. An important responsibility of the proposed new agency will be to work on a sustained basis with other agencies of Government, in consultation with the private sector, to achieve these objectives.

The marine resource industries have a common interest in the clarification of marine boundaries and jurisdictions. But the matters at stake in securing international agreements regarding the geographic extent of national jurisdiction over seabed resources and arrangements for exploring and exploiting resources in the areas beyond involve far ranging and difficult questions of national policy which require consideration also of the Nation's military and foreign policy interests.

The Commission recommends that the United States seize the opportunity for leadership which the present situation demands and has proposed a legal-political framework for overcoming present uncertainties. Its proposal anticipates redefinition of the "Continental Shelf" to fix its seaward limits at the 200 meter isobath or 50 nautical miles from the baseline for measuring the breadth of the territorial sea, whichever gives greater area; the creation of an "intermediate zone" to encompass the bed and subsoil of the deep sea in the band

lying seaward of the Continental Shelf as redefined to the 2,500 meter isobath or points 100 miles from the baseline; the creation of an international registry authority to register claims by nations to explore and exploit the mineral resources of the seabed and subsoil of the deep seas including the intermediate zones; and the creation of an international fund to receive payments from registering nations to be expended for such purposes as marine scientific activity, resource development, and aiding developing countries.

Dr. STRATTON. Thank you.

We turn now, with your consent, to the global environment, Dr. Robert White.

I should say Dr. White will have to leave at 12:15 for a meeting with the new Secretary of Commerce.

STATEMENT OF DR. ROBERT M. WHITE, ADMINISTRATOR, ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

Dr. WHITE. Mr. Chairman and members of the committee, you will find the global environment summarized on page 17 and I will depart a little bit from the practice of my fellow Commissioners. I would like to just comment informally on this material since the summary is in the paper before you.

The Commission came to the conclusion, after examining the problems the Nation has with respect to the oceans, that the Nation must attain a capability to observe, describe, and predict the processes of the oceans and the atmosphere on a global basis.

What kind of processes are we talking about? What kind of information does the Nation really need?

Our view was that they ranged from descriptions of the topography, geophysics and geological structure of the ocean floor, to an understanding of the normal conditions of the oceans, its chemistry, biology, thermal structure, and its motions, and the capability to predict the rapidly changing conditions of both the oceans and the atmosphere.

We came to the view that man must ultimately understand the sea and air and land as a single incredibly complex interacting system.

This is very clear because when one looks at the oceans one finds, for example, that surface ocean currents, and ocean temperature structure, are largely controlled by wind conditions of the atmosphere. It is impossible to describe or predict them without having a simultaneous knowledge of the atmospheric conditions over the oceans.

The reverse is also true; that is, that the conditions in the atmosphere are directly controlled by the conditions in the oceans. The extent to which the oceans affect the atmosphere is well known as in the case of hurricanes which are creatures of the oceans.

We also came to the view that the scope of the task of monitoring and predicting the global environment exceeded the capabilities of any one nation. One must do it on a global basis because the weather knows no national boundaries nor do the oceans, and this would necessitate the participation of all of the nations of the world in such a task.

We also came to the view that the existing systems which we have for achieving this goal are really not adequate at the present time, although, there are on the horizon now, under development or in

view, all kinds of new technology which should make it possible for the Nation to undertake this job. By this, I mean, we are already becoming aware of the capability of the satellites, data buoy systems, submersibles, and so forth, to do this job.

It really becomes, then, a question of how we will apply this new technology to this enormous task. We feel that there is no one way to go about this job. It is going to require a balanced program of research, exploration, technology development, and also the development of what we have called a global environmental monitoring and prediction system.

Why do we need such improved environmental knowledge? The reasons reach very deeply in to the fiber of our national life. It is quite clear that for the national security, or for those who operate in on or under the oceans for any purposes, it is absolutely essential that we know the sea state and temperatures and currents of the oceans. It is essential to the national economy in many ways that we have a very much improved capability forecast, both of the changes in the oceans and in the weather.

For example, the fishing industry would be well served if we could provide them with a knowledge of ocean currents and temperatures and predict their changes. The industry would be served by a knowledge of the topography of the ocean floor, and the patterns of life in the oceans.

It is quite clear also that because of the effect of the oceans on the atmosphere, we could, if we know more about the oceans and atmosphere over the oceans, provide inproved forecasts of the weather which would have tremendous implications for all of the activities we undertake not only at sea but on land as well. We would be able to provide improved protection of life and property and support the national economy in many ways. Land and sea transportation would be safer and more efficient. Our agricultural interests would be served by improved weather forecasts. Many other examples could be given.

These were some of the reasons that led us to the view that an effort to describe, monitor, and predict the global environment would be necessary.

Another thing that struck the Commission after a review of much of the work on environmental modification that had been undertaken in this country and abroad was that man is on the verge of being able to alter the behavior of his environment. There is a great need to understand man's effects upon his environment. There is a great need to be able to deal with this problem in a rational way. In this report we have recommended that the proposed new agency undertake the task of exploring both the feasibility and the consequences of modification of man's environment.

That is by way of background. The Commission has really come up with five major proposals with respect to global environment. The first, deals with the need for exploration of the biology, geophysics, and geochemistry of the seas. The second deals with the need for development of what we have called a comprehensive national system of monitoring and predicting changes in the sea, air, and certain aspects of the solid earth. The third deals with the need to conduct a systematic program of theoretical and experimental research into the problems of enviromental modification. And the last two address the importance of advancing international cooperation in oceanographic

matters to the national interest, and the importance of encouraging the maximum freedom of scientific research in the world oceans, because we are now reaching a point where we are finding increasing restrictions on the ability of our scientists to conduct scientific research in the world's oceans, especially in coastal waters of various nations.

With regard to the exploration of the oceans, we felt that the proposed International Decade of Ocean Exploration which has recently been supported in the United Nations would make an excellent vehicle for the conduct of such a program of exploration of the deep seas.

We feel that there are a large number of things with respect to the exploration of the deep seas we must do. I won't go into detail. However of special interest are two of the national projects which have been mentioned previously as means of focusing our technology development which we propose should be undertaken in connection with the national effort to explore the global environment.

The first of these deals with the development, construction, and use for civil purposes of a deep submersible which would have a 20,000-foot depth and ocean transit capability. A development of this kind would enable us to explore the ocean's depths on a global basis. The second deals with the need for an ocean data buoy network which would be advanced by a project such as that now presently being directed by the Coast Guard, to provide platforms for the taking of ocean and weather observations we are going to need on a global basis.

In connection with the need for a global environmental monitoring and prediction system, we are making the recommendation that the ocean and weather monitoring and prediction systems of this Nation should be brought together in some way so that they can be managed and planned in a systematic way. We would be using a variety of new technologies here, buoys, satellites, merchant vessels, and so forth, and any ocean monitoring system would have to be planned in concert with the weather system as well as in concert with similar systems being planned by other nations and by international organizations.

We feel that it is going to be necessary for the Department of Defense to be able to have the necessary capability to respond to its military needs with regard to environmental information. These two systems, the civil and military, as described in detail in the Commission report, would have to be planned and coordinated very closely to make sure that the information derived from one system was useful for the other system.

We make a number of recommendations for immediate improvements in our present environmental monitoring and prediction system which would not be very costly to the Nation. For example, today, out of a total of some 7,000 or 8,000 merchant ships available for acquiring ocean and weather observations, the nations of the world today acquire observations from some 3,500; of these, 2,000 are U.S. vessels. Here is an activity which could be augmented relatively quickly at very reasonable cost to provide additional observations.

With respect to environmental modification, we feel that the time has come to look at this problem in a long-range systematic way.

It is quite clear that there are growing concerns in the Nation as to what is happening to our environment. There is concern that the increase in carbon dioxide which results from the burning of fossil

fuels adversely affect our atmosphere. The Commission believes that we should understand what the consequences of this kind of thing are.

There is concern that the increase in the amount of dust in the atmosphere may also have deleterious effects. Within this and other countries there are significant efforts being directed at the conscious modification of environemntal processes.

We feel that a systematic investigation of the possibilities and consequences of environmental modification is an important problem for the Nation and one that should be undertaken by this new agency.

We recommend a number of research activities which have to be undertaken in connection with the programs I have mentioned, like understanding better the nature of ocean current systems, what causes them to fluctuate, what is the nature of the interaction between the atmosphere and the ocean.

Lastly, we have a great concern about what we think are growing difficulties in conducting scientific research in the waters of the world, and we feel that perhaps a new international convention on scientific research would be something that should be considered by this country and by the nations of the world to maximize the freedom to do such research.

Thank you, Mr. Chairman.

Dr. STRATTON. Thank you, Dr. White.

Gentlemen, I propose to pass over the chapter on technical and operating services, which is self-explanatory, and move directly to discussion of the heart of the matter: how to reorganize, mobilize our forces to advance these programs, and turn to Mr. George Reedy to report on that chapter, chapter 7.

STATEMENT OF GEORGE REEDY, PRESIDENT, STRUTHERS RESEARCH & DEVELOPMENT CORP.

Mr. REEDY. Gentlemen, before going directly to the specific reorganization proposals of the Commission, I would like to make one or two general statements to indicate some of the philosophy of the commission and to give some idea of the predicate upon which our proposals are based.

The Commission tackled this question of Federal reorganization with very few, if any, preconceived ideas. I will hesitate to speak for what is in the mind of another man, but I think it is quite accurate and quite valid to say that we began with no blueprints and we came to the question of organization after we had examined program needs and had reached some conclusions as to what we considered to be feasible and valid goals for the United States.

We did not really begin to put together our organizational proposals until after we had surveyed the field because our effort was to try to find the most effective type of organization that would (1) meet the problems; (2) reach the aims which we thought should be set before the country.

The second preliminary statement I would like to make is that naturally we did look to past examples and past models to see if they offered any guides and we really found very few. The Atomic Energy Commission example did not in any way give us guidance which was helpful because when the Congress was considering atomic energy, it was dealing with a force which, at least in its initial stages, could be

turned over to one agency. It was quite possible to build a building, put five men in it and say, "You have all the atoms in the world; you can deal them out in a bushel basket or in a teaspoon, but they are yours. You have the sole right to dispense with them."

The National Aeronautics and Space Administration offered superficial guidance to us in that it was the task of NASA to explore a dimension, outer space. Obviously in this field of ocean sciences we are again exploring a dimension. However, there is an extremely important difference. When NASA was set up, it was conceived as a vehicle to engage in a venture which in most respects was totally new. There was a necessity for organizing a vast effort which had very few precedents. But in this field of the ocean sciences and technology and engineering, we were really dealing with a number of activities which were already in existence, which were involving quite substantial sums of money and which were involving substantial numbers of people.

Nevertheless, they were activities scattered through a number of agencies and not necessarily coordinated. Our conclusion was that what we should try to achieve a form of organization which would permit a continuing effort and which would take advantage of the new knowledge that has been gained in the past few decades and bring the agencies together to meet problems which are increasing very rapidly.

To give some idea of the amount of effort that is already underway, the budget for the agencies which we propose to bring together, the 1969 budget, comes to approximately $800 million. It involves approximately 55,000 people in the Federal Establishment. So the problem is not one of creating something new to engage in a crash program. The problem is to find the most efficient and the most effective method of taking the work of those agencies, of bringing it together, and therefore of getting a maximum benefit out of all the new knowledge suddenly opened up to us.

The Commission's conclusion was that we have reached a stage in our knowledge of the oceans where we can no longer keep activities separated. You can no longer have one organization dealing with pollution and another organization dealing with fish and another organization dealing with minerals with none of them talking to each other and with walls between them. This not only leads to duplication of effort but is a system that lacks the intellectual cross-fertilization of people working on common problems who exchange ideas and who exchange new discoveries and new methods. We also evolved the concept of a new agency which would cover both atmospheric research and oceanic research because it seemed quite apparent from many of our studies that any separation between the two had a certain artificiality.

Therefore, what we proposed was to bring together the Environmental Services Agency, Coast Guard, Bureau of Commercial Fisheries, plus those aspects of the Bureau of Sports Fisheries and Wildlife which apply to anadromous and marine and coastal fish and the Great Lakes survey and we added the Sea Grant program and the National Oceanographic Data Center. We thought this new agency should be an independent agency reporting directly to the President because it seemed to us that if we are going to give a subject like this the prominense that it deserves and if this new agency is going to

play the role in our national life that we think it should play, it should have the capacity to make a direct claim upon the Federal effort and not be diluted by having to compete with a number of other subgroups before it gets to the primary source of authority.

The major functions of this new agency would be as follows:

Explore the marine frontier and its interrelationships with the atmosphere.

Define its resources.

Advance capabilities for its use.

Provide supporting services including weather and ocean forecasts.

Minimize conflicts over uses of the marine environment.

Coordinate scientific and technical requirements and recommendations in support of foreign policy objectives.

Serve marine industry and the marine interests of the American people.

Incidentally, I realize that I have failed to identify that part of the paper that I am reading. It begins at page 20.

There is one other step that we thought was highly important because we are not merely proposing a Federal agency to take over a specific governmental activity, we are proposing a national program, a program to involve the entire Nation; one that would set goals not just for the Government to achieve but for the encouragement of a national effort in all sectors, including the industrial sector and including the academic sector. Therefore, we have also suggested the establishment of the National Advisory Committee for the Oceans. This would be a Presidentially appointed committee which would have the task of advising the head of the new agency—the National Oceanographic and Atmospheric Agency—in carrying out his functions and of reporting periodically to the President and to the Congress on what progress was being made in achieving national objectives.

We considered this a recommendation of primary importance because this would be a way of assuring a continuous interchange between the Federal Government and the academic and industrial communities, all of which have a very vital stake in the oceans; which certainly have the right to be heard and without whose voices it is unlikely that a true oceanographic program would be successful.

To summarize, I think it is fair to say that the report has two aspects to it: (1) There are the many recommendations for new, expanded, or redirected programs, and (2) there is the question of the organization of the national effort, and that is something which would have extreme importance even if the other recommendations of the Commission were postponed for a period of time. We are spending a considerable amount of money in this field and I think the likelihood is that the amount of money we are spending will increase. It is bound to increase as the Nation's economy increases, as the Nation's population increases, and as our need to go into the ocean increases.

As I said, at the present time the budget for the agencies that we propose come to $800 million. All of that money is being spent in activities which are bound to expand, and one of the real problems here is assuring that those sums are spent effectively, that those sums are spent efficiently, and that the taxpayer gets the traditional 100 cents worth of value on his dollar.

Naturally we were also quite aware of the fact that we were engaging in an examination of the continuing process. What we say today may not at some future period of time accord with the realities that will arise as knowledge increases and as the Nation's economy changes. It may be that somewhere down the road many years from now a different type of organization will be called for. We had that in mind and tried to assure a degree of flexibility in this Agency that will permit sensible and prudent changes when sensible and prudent changes are called for.

Thank you.

Dr. STRATTON. Thank you, Mr. Reedy.

The report then concludes with a discussion of costs, and this, as you will well imagine, presented us with one of the most difficult problems.

I would like to ask that Dr. Lawrence, Executive Director, give you a brief account of how we went about that task, not taking time to emphasize the particular figures by what the premises were, what the limitation is, uncertainties might be, and how we proceeded.

Dr. Lawrence.

STATEMENT OF DR. SAMUEL A. LAWRENCE, EXECUTIVE DIRECTOR, COMMISSION ON MARINE SCIENCE, ENGINEERING, AND RESOURCES

Dr. LAWRENCE. Thank you, Mr. Chairman.

The material on costs begins at the bottom of page 23 of the highlights statement. We have also attached as attachment 2 two tables which appear in the Commission's report and which summarize the estimates which were developed by the Commission.

I might mention at this time, Mr. Chairman, that there is a third attachment to this highlights statement which represents the staff's effort to identify those recommendations of the Commission which would require legislative action, those where legislative action might be desirable and those where administrative authority appears to be sufficient to carry on.

The problem of projecting estimates for any program is difficult but it is compounded where one is dealing with fields which are rapidly developing, in which new technology is being brought to bear, and where proposals are being advanced for new programs regarding which there is little information or experience on which to base estimates.

As Mr. Reedy pointed out, there is also a large ongoing body of activity and experience on which the Commission is building. The estimates which have been developed by the Commission, therefore, represent a combination of projections on which we have fairly firm data on which to base our estimates for the future and estimates which have had to be developed with only very scanty knowledge to represent an approximate level of effort for getting new things done on which there is no experience.

Some of the national projects necessarily fall into the second cate gory, whereas in the area of developing marine fisheries there are ongoing programs. We know the approximate costs for survey activities that are being anticipated. Indeed, in that particular case we are able to draw on program papers which have been already devel-

oped by the Federal agencies. The Commission was able to review such plans and reach some conclusions.

Rather than reading the material in the statement which is available for your inspection, I might just briefly note some of the assumptions on which the Commission's estimates have been built.

Inevitably, such figures as the $8 billion expenditure over 10 years, which was seen in the press, are only as useful as knowledge how they are pulled together. There are some assumptions that need to be pointed out. First, the Commission in its report has attempted to set forth only the incremental costs of moving forward to implement its recommendations. The basic costs of carrying forward present programs is assumed in building these incremental estimates to continue at the present level throughout the 10-year period. Actually, as Mr. Reedy points out, there will be growth in these programs. whether action is taken on specific recommendations advanced by the Commission or not.

I think we can anticipate that these present activities will be growing at the rate of say 5 or 6 percent a year. That has been the pattern of the last 6 or 8 years. The additional amounts recommended by the Commission are not greatly larger than these growth rates.

Second, there has been an effort in these estimates to see how different parts of the program relate to one another. Whereas individually the numbers may be somewhat hazardous, in total they seemed to the Commission to represent an appropriate package for recommendation. The total level of effort, the mix of capital versus operating outlays, and the sequencing of activity so that an activity such as basic surveys was undertaken early in the program to provide the basis for other activities at a later time—these were all considered by the Commission and a judgment developed.

Third, I might note that the numbers which have been compiled by the Commission are not totally comprehensive of all aspects of the Nation's interests in the sea. They do represent just those amounts to implement recommendations of the Commission. They do not go to the activities of the Department of Defense oriented toward military purposes. They do not reach programs such as the Public Health Service sanitation activities which were not examined by the Commission. They do not—this is a very important point—attempt to bring in estimates for the costs of replacing ships that are operated by the present agencies or of meeting the routine requirements of keeping existing activities going, with which the agencies must be concerned with and regarding which they have in-house excellent projections since the Commission did not feel it was necessary to review their plans in order to develop its own proposals.

Thank you, Mr. Chairman.

Mr. STRATTON. Mr. Chairman, that completes our formal statement. I am sure that the members here would be happy to respond to questions you gentlemen may wish to present.

Mr. LENNON. In order to accommodate Dr. White, you say that you have to leave in 1 hour?

Dr. WHITE. 12:15, Mr. Chairman.

Mr. LENNON. We will direct our questions then to Dr. White to accommodate his situation.

Do you have questions of him?

Mr. MOSHER. I am not sure whether this is to Dr. White, but I note on this highlight document the statement on page 3: "* * * There is now no strong civil marine technology program." I think it is very striking throughout all your comments that repeatedly you indicate there is a lack of fundamental technology, that there is a need for the development of such technology in nearly every area. So I raise the question whether in the creation of NOAA——

Dr. STRATTON. This is a suggestion we have made.

Mr. MOSHER (continuing). Or "the Ark," as some newspaperman said——

Dr. STRATTON. We had some fear of that.

Mr. MOSHER. In the creation of NOAA, do you contemplate it will operate its own laboratories, establishments for the development of such fundamental marine technology, and testing of such technology, similar to NASA's laboratories for the development of their hardware and technology for space exploration? Will NOAA have its own laboratories? There is a reference here to NOAA subsidizing private industry development. What about the use of other Government laboratories?

Dr. STRATTON. I am going to suggest Mr. Perry respond. He chaired the panel on technology. I suspect after he is finished there may be other comments here.

Mr. PERRY. Mr. Mosher, we treated this subject in the Commission report and also in the panel report on technology at considerable depth. Basically it will all depend on what the problem is. One of the concepts of NACO was to help advise NOAA, the civilian government agency, as how to best solve a particular problem.

For instance, take the technology of glass development. There are several private companies and research institutions doing work on glass. They have built up a certain amount of test facilities, and so forth, and it would be unnecessary and perhaps unwise to have the Government build another one or parallel-type facility.

The Navy itself has tremendous capability in this field and we propose having the NOAA use it on a reimbursable basis. On the other hand, there are certain fundamental technology research facilities which nobody has and which are too expensive for a single industy or single university to build on its own. It would be the decision of NOAA, with the advice of NACO, to decide whether it was more economical and satisfactory to have the Government actually build or build and lease or to have a private industry build on a cost-reimbursement basis. You have to get down to each individual case to determine what is the wise course. The fundamental structure which we proposed here is the NOAA and NACO plus the help of Navy technology, and their present facilities should enable the best and most economical course.

Mr. MOSHER. You are saying that the Commission is remaining flexible on this subject and that NOAA might well find it had to develop some of its own labs, but you don't know for sure?

Mr. PERRY. That is right. It depends on the problems you are going to encounter.

Mr. MOSHER. You refer to NACO. In these highlights there is no reference to staffing for that body. Do you contemplate a professional staff?

Mr. PERRY. Yes, sir. We mentioned it in the report. There is a small full-time staff. The Chairman should be full time. The other members should be part time and advisory basis.

Mr. MOSHER. Just one more question.

On page 22, you use the phrase "at least initially" NOAA should be an independent agency reporting directly to the President. I think, Mr. Reedy, you have already answered that in your previous comment, you have already answered my question. I would like to emphasize this. If I understand this correctly, the Commission is saying that it is imperative for the future of our national program in the marine sciences, the use of the oceans, it is imperative we have some reorganization, and soon, of the executive agencies. You have come up with NOAA as the best proposal that you can conceive. You are emphasizing, by the use of the word "initially," that there can be a developing situation here, an evolution in this organization, and that it ultimately might be much more than the independent agency that you propose, or perhaps somewhat less; is that right?

Mr. REEDY. Your understanding is correct, Congressman. We proceeded on the assumption that marine activities are something mankind has been engaged in since the beginning of man and that over all of these centuries we have been gradually increasing our knowledge of the seas.

What we are recommending here in our organization proposals is the type of organization that we think is best for right now. But we are sufficiently modest and have a sufficient amount of humility to realize that knowledge is going to increase and that the emphasis upon which this Nation does is bound to change. We believe that the importance of these marine activities is going to increase and that it is going to occupy a larger and larger part in our daily lives. It is going to be something which will concern every citizen and therefore we were anxious not to come up with a recommendation that would freeze the country into a type of organization which might be inadequate down the road.

For this particular point in time and for quite some distance ahead it is our judgment this is the best form of organization to meet the problems that we have and to take advantage of the opportunities that we have.

Mr. MOSHER. Would it be accurate also to say that the Commission recognizes the political practicalities of this recommendation, the fact it is going to create a lot of infighting within the bureaucracy and within the Congress and between congressional committees, their jurisdictional boundaries threatened, that sort of thing?

Mr. REEDY. We were quite aware of that.

Mr. MOSHER. Recognizing that, is it also fair or accurate to interpret the Commission's feeling that you are not totally insistent on NOAA as the instrument, that Congress has to approve? You are not rigid on this, you are flexible and you probably recognize the Congress is going to have to look at this proposal in the light of whatever new recommendations the new administration comes up with, whatever new philosophy the new administration may have about overall streamlining or reorganization of the executive agencies? Would you contemplate that the Congress is going to have to take a little time to look at this situation?

Mr. REEDY. Of course Congress will have to take some time in looking at it. What we did was to set up what we considered the best form of organization that we could arrive at on the basis of the problems we had studied. We are quite well aware of the fact that there may be many other considerations involved.

We were also aware of the fact that these proposals will create some irritation, will create some infighting, and therefore we did not make these recommendations lightly. This is not a question of our coming across a series of agencies and saying they should be put together regardless of the consequences. We didn't propose to break up any crockery. The recommendations that we made, Congressman, were based on our belief that they are of sufficient importance that it is worthwhile at this time to discuss them and try to effectuate them. But also we are quite well aware of the other realities.

Mr. MOSHER. Since you do recognize it is going to take the Congress some time to consider these proposals, I assume you do consider one of your important recommendations that the National Council on Marine Resources and Engineering Development be continued as an interim body, at least until Congress and the President do determine a more permanent reorganization form?

Mr. REEDY. Yes; that is a very important recommendation. It was not thrown in as an afterthought. Obviously it is the coordinating agency at the moment. When the Federal Government is spending seven hundred or eight hundred million dollars a year scattered through a number of agencies, it is important, I think—and I believe the Commission thinks so, too—that we have the maximum that we can get of coordination and effectiveness out of this money.

Until our recommendations are acted upon, we believe it is very vital to maintain the Marine Council.

Mr. MOSHER. No further questions.

Dr. STRATTON. Mr. Chairman, may I add a comment or two to this, just to underscore what Mr. Reedy said.

In the first place, as he noted, we did not enter into this task with preconceived ideas of how the Government should be organized for this program of the oceans. We propose that the organization—hope that the plan of organization would emerge out of the program itself as we, month by month, went deeper and deeper into the whole field and determine what needed to be done. Then we began to see who was going to do it and there began to emerge relationships between existing agencies which needed to be strengthened and clearly functions which were not now being performed which must be undertaken in the future.

So out of that there came or began to come this concept of a grouping of existing activities and further functions which have to be performed. I think it is fair to say that from the outset we were very, very conscious of the problems involved, and that no matter what kind of a proposal we made, if it had any strength whatsoever, any prospect of getting on with the job, it was bound to encounter controversy and difficulty and vested interests and conflict of interest, all perfectly natural because of the long time and long history in which this has taken place.

We did consider from time to time the possibility of, bringing these related activities together within one of the departments but it

became clear that this would imply recommendations for such massive changes within that department as to be beyond our jurisdiction, for it would be presumptive for us to say that this department or that should be fundamentally reorganized for this purpose. So we ended up by recommending to you what we believe has to be done in the way of bringing together and of giving force and effectiveness.

I think it is the most important thing that can come out of this whole effort, that we move along those general directions. We are, as you have indicated, conscious of the problems. We recognize that it will take time. We also are reminded that the reason for an independent commission and the instructions that you gave us were precisely that we should look and make our recommendations based on what we thought was best for the country and then we should have to look after the consequences later on.

I hope that that is implied here. The word, Mr. Mosher, "initially" really applies to this. We recognize an evolutionary process. We contemplate the new administration is going to consider the structure and we do not by this recommendation or proposal want to preclude such kinds of decisions with respect to the oceans.

Mr. MOSHER. That is all.

Mr. LENNON. Mr. Rogers.

Mr. ROGERS. Thank you, Mr. Chairman.

Of course, I would hope in continuation of this discussion we are having now that the present powers that died with the end of the last Congress and its law on giving the President the right to reorganize the Government—I would hope that this power will be reestablished and I plan to help in this effort. I hope and I feel sure Congress will give the President the right to reorganize as has been given other Presidents. It would seem to me that if we can go through that process, this would be the most expeditious and efficient way of bringing about this reorganization. I think that it would have a tendency to keep infighting down which was brought up through a reorganization plan.

I think it is well to note, too, that those functions that you have suggested be brought together in NOAA for the most part are under the jurisdiction of this committee. I do not think we will have too much of the committee jurisdiction problem as much as we would have the agency reaction.

Let me ask this: Did you give any consideration to placing the merchant marine within this agency?

Dr. STRATTON. Mr. Rogers, there was a good deal of discussion about what our responsibilities were and what we should endeavor to do in connection with the merchant marine. I am afraid we backed away on it. It was a matter of time, a recognition of the complexity of many factors, political, labor, and otherwise, and the fact that there were other groups working with them. There were various suggestions made that perhaps at the end we should propose that the merchant marine should be placed in one agency or another, in this one or the Department of Transportation and that we should take a position on that.

I think the unanimous feeling of the Commission members was, however, at the end, that since we had said we were not prepared to discuss the merchant marine problem basically, it would be presumptuous to come in with a sort of gratuitous recommendation to be placed in the Department of Transportation or here.

Mr. ROGERS. Thank you, Mr. Chairman.

Mr. LENNON. Mr. Keith?

Mr. KEITH. Thank you, Mr. Chairman.

I along with Mr. Rogers, am hopeful that we can get from the executive branch of government a great deal of leadership that might be helpful in approaching this whole problem that you have spoken so eloquently about and your panel.

This has been very helpful to us, in informing us as to the scope of your work, and the scope of the problem that will face us as we try to deal with your recommendations.

I have lots of questions as to how. I have the Woods Hole project in my district. The Bureau of Commercial Fisheries has a substantial operation within my constituency. The Coast Guard is very heavily represented, too, plus shipbuilding and the fishing industry. It is a big ball of wax and I am going to look for some help. I am concerned about what is going to happen to the organization that you people have when you go out of existence or have gone out of existence on February 9——

Dr. STRATTON. Yes, sir.

Mr. KEITH. Your staff is going to be scattered to the four winds.

Dr. STRATTON. To the four winds or the seas. I am afraid we are going to be dispersed.

Mr. KEITH. Have you any advice for me as a Congressman as to how I might proceed to satisfy my constituents in this regard? I am asking, for example, somebody from Woods Hole, Coast Guard, somebody from the fishing industry to survey your recommendations. But is seems almost premature until we have heard a Federal agency in trying to demand money to implement your recommendations, for me to have them other than just familiarize themselves with it. I would appreciate your comment.

Dr. STRATTON. Mr. Keith, this is a subject that has given and is giving us much concern, too. You can understand that the members of the Commission have worked so very hard over the past 2 years, have given a great deal of time, and although in one way we might wish to be free, we have also become involved. We feel very strongly a responsibility of trying to carry this through and I think we shall have to act as individuals working together to give whatever help we can to you and the Members of the Congress in whatever fashion possible.

We are discussing this a little bit ourselves. In your particular area, of course, as you say, these problems are very much to the fore. You spoke of Woods Hole which would be directly affected presumably by the recommendation for University National Laboratories. And then the problems of the fisheries. I have already had one comment from New England, the fishing industry saying, "This is splendid. How do we support it and get on with it?" I cannot answer that at the present time.

It affects you in every possible way. I must say that I feel somewhat in the same position. I need advice, and all of us do here, in suggestions on how we work together and keep together to give support to Members of Congress and whoever is concerned.

Mr. KEITH. I am not going to pursue any of the numerous questions that are naturally raised here, except to comment.

Knowledge is power and you have given us a lot of knowledge. We hope that we can act with authority from that knowledge. If any of your colleagues would care to comment further as to that, I would appreciate it.

Dr. STRATTON. I would like to ask Dr. Knauss to comment perhaps because he has been much concerned about the future and how we continue to support it. He comes from somewhere near you.

Mr. KEITH. I know. Sometimes it is a rival institution and other times——

Dr. STRATTON. On this we are not rival institutions; we are all supporting the same cause.

Dr. KNAUSS. I can only say, Mr. Keith, since I am familiar with the report and do live close to your district, that I would be delighted to help you in whatever way I can. I have already spoken to the Board of Trustees of the Woods Hole Oceanographic Institution last week on the Commission report. I told Dr. Fye I would cooperate in whatever way I could in helping to interpret this report.

Mr. KEITH. There was one area that you have some expertise and responsibility to. I think this would be important that we mentioned this. You talk about redefining Continental Shelf. Yet it seems to me that internationally there has been a trend to the current definition. Would this not fly in the face of international custom and law? Would we not be going over on a brand new track in the definition of a Continental Shelf?

Dr. KNAUSS. Are you referring to the statement in this highlight document or to the report?

Mr. KEITH. In the highlights.

Dr. KNAUSS. I think when you have the opportunity to read that part of the report which deals with this in considerable depth, that perhaps your question will be answered. What we are making is a recommendation with respect to possible changes in international conventions because we feel that the present conventions are inadequate to the task at hand. We do this with full knowledge of what the present situation is and full awareness of what the problems are.

Mr. KEITH. I know that you have advanced the theory from time to time that we should have 200 miles, or the press has indicated that.

Dr. KNAUSS. One thing about a university is that we do not always speak with one voice. There are colleagues of mine at the University of Rhode Island who said so, but I have not.

Mr. DOWNING. I, too, would like to compliment you and the members of the Commission on this magnificent job which has culminated in this report. Not only is it a great document but it is interesting to read, which I think is a great tribute to whomever put it together.

I can see where some of the things you have recommended will be controversial, but on the whole I think it is a fine report. I believe I can back most of it.

I am particularly interested in the coastal zones which you suggest setting up and I am interested in relation to my own district which is a coastal area, as you know. It has an excellent laboratory, the Virginia Institute of Marine Science. It also has several universities interested in oceanography.

Would you mind briefly describing how this would work?

Dr. KNAUSS. Which area would you like me to talk about first, the university laboratories or the State management systems?

Mr. DOWNING. How will you coordinate this? In my instance how do you picture our work and that of VIMS and that of the university? Would it be necessary to have a university?

Dr. KNAUSS. The examples of VIMS was strong in our minds because it seems to me in some sense VIMS does represent a coastal zone laboratory, at least many elements of such a lab. We feel probably within every coastal State there should be a group interested in all aspects of the problem of the coastal zone.

We do not feel that these laboratories have to be necessarily connected with one university but that several universities, as in the case of VIMS, could be affiliated with the coastal zone laboratory.

We are not necessarily thinking of starting up new laboratories. For example, consider the situation in Mr. Lennon's State where Duke, North Carolina State, and the University of North Carolina, are involved in marine efforts. One can imagine building upon one of the existing laboratories in a way that all three of these institutions would be somehow involved or affiliated.

That is what we had in mind. We think the coastal zones are so important that there should be perhaps within each coastal State some such laboratory, but we do not feel there has to be one laboratory per university or per college.

Mr. DOWNING. Would it be a requisite that the laboratory be tied into the university?

Dr. KNAUSS. We have not so stated but it is strongly implied.

Mr. DOWNING. Who would designate the leadership in the coastal zone? Would the State setup the administrative headquarters?

Dr. KNAUSS. The States will have to pay a share of the cost of the coastal zone laboratories, thus, I think they would have a strong say in this.

Mr. DOWNING. Some of your recommendations for legislation will perhaps run into controversy. One that I see is to discontinue the policy of preventing the use of foreign-built fishing vessels by American fishermen.

When you went into this did you also go into the impact this might have on the American shipyards, the American fishermen, and possible reduction of value of present fishing vessels and related matters?

Dr. ADAMS. I think we did, sir. The feeling of the Commission was that the present means of trying to bet a more efficient fishing fleet has not worked very well. The present subsidy program has been more of a subsidy for the shipbuilders to continue their present way of life than it has of the fishermen to adopt more efficient vessels.

It was the Commission's feeling that the best way of getting around this situation and developing a better fishing fleet was to permit American fishing fleets to purchase their vessels and gear wherever they want at the most competitive price.

We felt the old act was an impediment and should be repealed.

We did recognize this would cause some temporary turmoil in the shipbuilding industry but we felt the long-range effect would be a more efficient fleet and more efficient shipbuilding industry.

Mr. DOWNING. And you provide for the extension of subsidies for fishing vessels?

Dr. ADAMS. With amendments; yes, sir.

Mr. DOWNING. Do you have any details on that?

Dr. ADAMS. Our recommendation was that there be a flat 50-percent subsidy rate and not the present system of having to get foreign bids and compare them with domestic bids. We felt this really cut down the efficiency of the whole program because there was so much red tape between the fishermen and the vessel that the whole program was jeopardized.

Mr. KEITH. You got good advice there.

Mr. DOWNING. One of the recommendations was to recodify laws on vessel safety standards, extend certificates, provide safety standards for commercial fishing vessels, empower Coast Guard to establish minimum safety standards for pleasure boats.

Is that not being a little presumptuous in so far as your main effort with oceanography is concerned?

Dr. ADAMS. This comes from industry, I believe. I will comment on one part of it. Of all groups of vessels in coastal operations, fishing vessels have a higher casualty rate than any others. The feeling even within the fishing industry is that the industry needs a little encouragement here to design their vessels more safely and to operate them more safely. This is one means of asserting a little courage here.

Mr. DOWNING. What, if any, agency not included in NOAA was seriously considered for inclusion?

Dr. STRATTON. Obviously the Geological Survey of the Department of the Interior, some functions of the Corps of Engineers.

The real problem of the Geological Survey was that some of the functions they perform will have to be performed—or there are parallel actions on the seabed.

Our conclusion was that the Geological Survey was too intimately involved in land and other programs and we could not see how to justify moving them over to the sea.

Mr. LENNON. The Commission, of course, had representatives from the Federal Government, the Department of Commerce, the Department of the Interior, DOD, and the Department of the Navy.

Would you gentlemen say either on the record or off the record that the report was unanimous respecting the mandate of the legislation which you are requesting? Was this a unanimous consensus of the Commission with respect to the organizational plan?

Dr. WHITE. We participated, the three Government members, in all discussions dealing with this organization. We have not, however, taken a position with regard to the specific proposals now being recommended by the Commission.

I can speak only for myself as a representative from the Government as to what my view is, sir. That is that this is an innovative and imaginative way by which one can organize and manage the efforts recommended by the Commission.

On the other hand, I do act in my official capacity as a member of the Department of Commerce and a member of the executive branch. There are discussions going on in the executive branch with regard to where it would like to go in this area.

I feel it is only proper for myself, sir, to await any kinds of proposals or recommendations from the executive branch of the Gov-

ernment before taking a position with regard to which organization would be most appropriate.

Mr. LENNON. On page 1 of chapter 7, and I read it:

Present Federal Marine activities have grown over the years largely without plan to meet specific situations and problems, and are scattered among many Federal agencies.

Would you agree or disagree with that?

Dr. WHITE. I agree with that statement, sir.

Mr. LENNON. "Imbedded within many Federal departments are important activities which relate only marginally to the central missions of the Department."

Do you agree with that statement?

Dr. WHITE. Yes; I do.

Mr. LENNON. Reading now from page 4 of chapter 7, beginning on line 12:

Many of the scattered marine programs are too small to have impact. Equally important, their isolation from each other, which coordinating mechanisms are never able to overcome, has caused an inevitable degree of insularity, overlap, and competition. But perhaps most significantly, their isolation has made it very difficult to launch a comprehensive and integrated program to remove the obstacles that stand in the way of full utilization of the oceans and their resources.

Do you agree with that?

Dr. WHITE. This would be a matter of degree, Mr. Chairman. I think there is some of that. I don't know as I would phrase it exactly that way.

Mr. LENNON. It so happens you are the only member of the Commission here this morning from the Federal Government and I would like to get this for the record.

I read further from page 5 of chapter 7, line 10:

It is our conviction that the objective of the National Ocean Program recommended by this Commission can be achieved only by creating a strong civil agency within the Federal Government with adequate authority and adequate resources. No such agency now exists, and no existing single Federal agency provides an adequate base on which to build such an organization. For the National Ocean effort we propose, unified management of certain key functions is essential.

How do you feel about that statement?

Dr. WHITE. I agree with that.

Mr. LENNON. On page 22 of the highlights, second paragraph:

The size and scope of the program recommended by the Commission requires that NOAA, at least initially, be an independent agency reporting directly to the President. In getting a major and diverse effort under way the case for independent status is compelling.

Would you comment on that?

Dr. WHITE. This is the kind of thing I feel I should reserve my position on until I see the proposals as to how these efforts might be brought together or managed in an effective way.

Mr. LENNON. Thank you very much, Doctor. That is a very frank and fine statement.

You may continue, Mr. Downing.

Dr. STRATTON. You asked about what other agencies were considered. I said we had considered the relations of the Corps of Engineers, of the Geological Survey. At times, naturally, the resources of NASA were considered. NASA does have extraordinary facilities and we would hope that the new agency would find ways of taking advantage of those facilities by interchange.

One of the functions we considered was the Fresh Water Pollution Control Administration, the FWPCA. The Navy Oceanographic Office also was taken into account.

For one reason or another we came out with this arrangement.

Mr. DOWNING. Thank you very much, Mr. Chairman.

Mr. KARTH. Mr. Chairman, I have a number of questions but in the interest of time I would like to ask two.

First of all, this may be redundant, but let me say that I want also to commend the Commission for the courage they have shown in making the recommendations, that we are to concentrate and bring together the influence and activities of the Federal Government so as to extract from whatever our inputs are, the most advantageous output.

While this will, I suppose, precipitate some infighting both in the executive branch of Government and in the Congress, I personally feel strongly that if we cannot implement this recommendation then for all practical purposes the worthwhileness of this report has been seriously reduced in terms of effectiveness.

Would you agree with that?

Dr. STRATTON. This is exactly our feeling, sir.

Mr. KARTH. There is one potential, and I say potential, conflict or disparity with that recommendation and one of the others you made. I say "potential" because it may be I do not understand completely what your recommendations really are.

While on the one hand you recommend concentration of effort on the part of the Federal Government, it seemed to me you also recommended that we allow the many States to determine what programs they think they ought to follow or pursue off their own respective shelves, and this might have somewhat the same effect as we have had now in the Federal Government.

Dr. STRATTON. Again this falls in Dr. Knauss' domain.

Mr. KARTH. My feeling is that because there are many States involved, unless we have some coordinated effort pursued by the States, you may well have a much-fragmented program.

Dr. STRATTON. This is a very difficult area which you know so well, the relationship between the self-determination of the States and the regions as against the Federal power. The question was how to find a balance of power.

Dr. KNAUSS. We were very much aware of this. I hope you have misinterpreted our recommendation because we think we have come up with a plan that will improve matters in this area.

Our feeling was and is that the difficulties within the coastal zone are in part because there are so many Federal agencies involved in the coastal zone. Even with an NOAA, there will be the Navy, the Army Corps of Engineers, FWPCA, Public Health Service, Bureau of Outdoor Recreation, and others.

It is our impression that the States have tended to react to Federal programs. There has been little in the way of coordinated and unified approach.

We hope that by building strength within each State by the establishment of coastal zone authorities that each State would develop a strong unified effort. NOAA could provide the coordinating function. In attempting to build up this kind of strength within each State we fully recognize that the management of the coastal zone is primarily a State function.

Mr. KARTH. I appreciate the problems you have had in wrestling with this question. The only fear I have is that because of this we might well precipitate a program in the final analysis which is perhaps not integrated or concentrated.

Let us say, perhaps, that State X which is contiguous to State Y has as its only interest the exploration of oil, while State Y is interested for any number of reasons in fishing and therefore antipollution and those many things contributing to it.

Is it not possible that because of the contiguousness of the two States that one might well dilute the efforts of the other and make them unwholesome?

Dr. KNAUSS. I would like to read from page 60 of the report:

> Without under-estimating potential difficulties, the Commission was persuaded that in most cases management undertaken by one state will perhaps not differ greatly from that undertaken by another state. When differences do arise they may be settled by direct negotiation or by the establishment of ad hoc interstate committees or an interstate commerce or compact. Strong coastal zone authorities representing the variety of state interests will facilitate such agreements.
>
> The Commission believes such interstate agreements are preferable to coordination through river basin commissions in which the Federal Government is a member. Not having management or enforcement authority such commissions can only plan and advise.

Mr. KARTH. These regional groups do not engage themselves in negotiations and usually each State follows its own interests.

I notice on page 23 that you recommend a presidentially appointed advisory committee for NOAA. Is your recommendation based pretty much upon the way the National Space Council operates today, or would you give that committee additional powers which the National Space Council today does not have?

Mr. REEDY. There would be some resemblances, Congressman. The fundamental thought here is to have a body of men who can provide a two-way exchange of information. The powers of this organization would not be administrative powers. It would not have anything to administer other than a small staff. Its functions would be primarily those of evaluation and of assuring that there is a continuous exchange of information between the governmental authorities, primarily NOAA, and private industry and the academic community.

In this way, since this is a national effort rather than specifically a governmental effort, you do have close connections between industry, the academic community—and I forgot to include the States in my previous statement—and governmental authority itself. However, it would not administer anything. It would not have contractual authority. It would not have any authority other than to evaluate, advise, and exchange information.

Mr. KARTH. The report says to advise the head of NOAA in carrying out his functions. That is a pretty broad and general statement and implies to me in part, at least, that he would have some administrative responsibility in initiating programs and perhaps carrying them out.

Mr. REEDY. In suggesting, yes, suggesting programs, advising, and recommending.

Mr. KARTH. No authority other than advising?

Mr. REEDY. No. It would be advice on an extremely broad field because we are talking about a very broad field. There would be no contractual authority and there would be no administrative authority.

Mr. LENNON. Is it the thought of the Commission that the National Council's life should be extended for 6 months beyond its present expiration date or for the period of a year from its present expiration date, or until such time as the recommendations of the Commission are implemented?

Dr. STRATTON. Our feeling has been that it should be extended until uch time as some of these actions are taken. We have had the very highest respect for the Council. It has accomplished a great deal over the past year.

We are convinced that in the long term it cannot carry out the operations and serve as the protagonist and the advocate in the way that an operating department can. That is the only reason.

However, in the meantime to dismiss the Council without having something established in its place would seem to us a loss.

I trust the other members are in agreement with that statment.

Mr. LENNON. Speaking of the NACO, the National Advisory Commission on Aeronautics was created in 1915, was it not?

Dr. STRATTON. Yes, sir.

Mr. LENNON. Someone has suggested the possibility of the creation of a National Advisory Committee on Oceanography in anticipation of the implementation of the recommendations of the report to permit such an organization to establish a dialogue with the several State agencies, particularly the coastal and Great Lakes areas, in order to bring into being these coastal laboratories and try to resolve some of these matters pending the final implementation by Congress of some of the more specific recommendations concerning the independent organization.

Would you have any comments on that?

Mr. REEDY. I think there might be something of a problem in this, Mr. Chairman, although I do not feel strongly about the problem. There might be something of a problem in determining what this advisory commission should be attached to. I have a feeling, based upon past experience, that when an advisory commission is set up, even if for administrative purposes you say "to advise the President," it does not have the same impact that it does when you set it up with a connection to a specific agency that has contractual and administrative authority.

On this I would not presume to speak for the members of the Commission. My own individual thought is that for the time being such functions are perhaps best lodged in the Council.

Mr. LENNON. The thought was advanced that an active NACO begin now to work for the coastal areas and laboratories. The thought was further that they could work with the National Council until formation of the new agency.

Do you think the coastal States areas will just stand still until Congress takes action, which can be months or years from now?

Mr. REEDY. I really do not have final conclusions on this. I have a certain amount of reservation in my own mind as to the effectiveness of a Commission which does not have a specific contractural administrative agency.

Mr. PERRY. In regard to the question about whether the States will sit still in the meantime, I don't think they will. As a matter of fact, in Miami they already formed a State Maritime Association and it

was quite successful. It encouraged the members of the various coastal States to work together in working out their individual problems.

One of the problems, for instance, is a boundary line between Florida and Georgia. They worked that out very successfully at that meeting. They were all very enthusiastic about getting into the contents of the Commission's report which at that point was not yet released.

If those member States are an integral part of the NACO it will eliminate a lot of lack of communication which now exists between the States and the Federal Government on these various aspects of the Commission's report.

Mr. LENNON. Off the record.

(Discussion off the record.)

Mr. LENNON. Gentlemen, if there are no other comments, we will go back on the record to state the meeting is adjourned subject to the call of the Chair.

Dr. STRATTON. Thank you very much.

(Whereupon, at 12:44 p.m., the subcommittee adjourned subject to the call of the Chair.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

TUESDAY, APRIL 29, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:10 a.m., pursuant to call, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. The meeting will please come to order.

It is customary in the beginning of the convening of a hearing such as we contemplate here for the presiding officer of the committee or subcommittee to make a statement. I am pleased to do so now.

We are meeting today to initiate a series of comprehensive hearings on the report of the Commission on Marine Science, Engineering, and Resources, which was sent to the President and to the Congress on January 9, 1969, in accordance with the requirements of the Marine Resources and Engineering Development Act of 1966.

Most of you are familiar with the act and its background but for the record let me repeat:

The Marine Resources and Engineering Development Act of 1966 was enacted on June 17, 1966, after some 7 years of intensive and comprehensive work by the Congress to develop an effective statutory base for a comprehensive long-range and coordinated national program in marine science.

The act set forth a declaration of national policy and objectives for a national oceanographic program. It created, as you will recall, the National Council on Marine Resources and Engineering Development to serve as an ongoing coordinating body of all governmental activities in the fields of marine sciences.

As you will recall also, it created a Commission on Marine Science, Engineering, and Resources to review existing programs and come up with recommendations for a long-range national program consistent with the declared statement of policy, including an organizational structure for future administration, oversight, and implementation of such a long-range program.

This Commission, under the distinguished and outstanding chairmanship of Dr. Julius A. Stratton, former president of the Massachusetts Institute of Technology, was composed of 15 members, 11 from the public sector, and three from the Government—all able and exceptionally highly qualified individuals.

The monumental report covering all major areas of marine science and marine affairs affecting the national interest is the subject of our

current hearings and will provide the basis, hopefully, for necessary legislation as we move further along.

Their report is entitled "Our Nation and the Sea."

The Commission has worked with great concentration and energy for the past two years and has met the requirements of the Marine Sciences Act of 1966 by submitting its report to the President and to the Congress on January 9 this year. We in Congress can do no less than to meet as promptly as possible, and with all the concentration necessary, with responsibilities to review the Commission's voluminous report and its numerous and far-reaching recommendations.

And then, gentlemen, we should take such action as we believe is necessary to implement these recommendations. I believe that we can agree that this report will go down in history as one of the great efforts made by private citizens, in cooperation with the Government, in an effort to plan for man's long-range understanding and use of the oceanic environment which covers 71 percent of the earth's surface.

Let me say in this connection that this is the first of the hearings, the kickoff hearing. The hearings will continue on May 6, 7, and 8, and May 13, 14, and 15, and May 20, 21, and 22. It is our hope that all the private sector, those desiring to be heard, will make themselves available on any one of those several dates, our universities, our private laboratories and all interested individuals.

In additional hearings, the Government representatives of the various agencies which are involved in the marine sciences in any degree and who may be affected by the proposed governmental structure that is recommended by the Commission will, of course, be heard.

I might comment by saying that a letter has been directed to all the Government agencies that could be affected by this Commission report in which they are requested not only to make themselves available to the committee on one of the dates that I foresee in the future, after those approximately 14 that we have already scheduled, but they have been asked to submit their views in writing starting with the Bureau of the Budget in the Office of the President of the United States and through the whole sector of the Government agencies.

Dr. Stratton, I am most pleased to welcome you and your former fellow commissioners this morning as we open our first public hearing into all facets of your splendid report.

I am going to take the liberty to announce those who are here today who are former members of this great Commission, and then, Dr. Stratton, if you will introduce them: The Honorable Richard A. Geyer, head of the Department of Oceanography, Texas A. & M. University; Charles F. Baird, vice president of the International Nickel Co.; James A. Crutchfield, professor of economics of the University of Washington; John A. Knauss, dean of the graduate school of oceanography, University of Rhode Island; John H. Perry, Jr., president of Perry Publications, Inc.; George E. Reedy, president of Struthers Research & Development Corp., and Dr. George Sullivan, consulting scientist, General Electric Reentry Systems.

Are there other members of the Commission that I have not read from the list furnished me?

Of course we are delighted to have our former, I guess you would call it, executive director or research analyst of this great Commission, Sam Lawrence.

Do you have a prepared statement, Dr. Stratton, this morning? How would you like to proceed? If you will just come forward and bring

with you, if you like, to the table there those whom you want to have participate with you in your statement, you may handle it in any way you like.

STATEMENT OF DR. JULIUS A. STRATTON, FORMER CHAIRMAN, COMMISSION ON MARINE SCIENCE, ENGINEERING AND RESOURCES, ACCOMPANIED BY FORMER MEMBERS OF THE COMMISSION, RICHARD A. GEYER, HEAD, DEPARTMENT OF OCEANOGRAPHY, TEXAS A. & M. UNIVERSITY; CHARLES F. BAIRD, VICE PRESIDENT, INTERNATIONAL NICKEL CO.; JAMES A. CRUTCHFIELD, PROFESSOR OF ECONOMICS, UNIVERSITY OF WASHINGTON; JOHN A. KNAUSS, DEAN, GRADUATE SCHOOL OF OCEANOGRAPHY, UNVERSITY OF RHODE ISLAND; JOHN H. PERRY, JR., PRESIDENT, PERRY PUBLICATIONS, INC.; GEORGE E. REEDY, PRESIDENT, STRUTHERS RESEARCH & DEVELOPMENT CORP.; GEORGE H. SULLIVAN, GENERAL ELECTRIC CO.; AND THE FORMER EXECUTIVE DIRECTOR, SAMUEL A. LAWRENCE

Dr. STRATTON. Mr. Chairman, and gentlemen, thank you very much. If it had been at all possible every member of the Commission would have been here this morning. I am gratified and very appreciative that there are eight of us here.

Would you like me to ask them to rise? I would like to have them all up here but it is not feasible.

Mr. LENNON. I see that, but it would be so helpful to have them stand up as you recognize them.

Dr. STRATTON. Dr. Geyer is the vice chairman.

Mr. Perry—not taking them alphabetically—Dr. Sullivan, Dr. Knauss, from Rhode Island, Mr. Reedy, Professor Crutchfield, from the University of Washington, Mr. Baird, and Dr. Lawrence.

I believe I have covered them.

Mr. LENNON. Thank you very much, Doctor.

Dr. STRATTON. With your permission, gentlemen, I had prepared an opening statement to launch the discussion. I will present this first, and then in the question period I would like to call upon my associates here who are particularly informed in one area or another.

I would like to say, Mr. Chairman, that we are hopeful and confident that the hearings you have planned for these coming weeks may lead to developments of historic importance for the benefit of our country, and we welcome this opportunity to discuss our findings and conclusions.

As you indicated, Mr. Chairman, the Commission has completed its formal assignment. Our report has been rendered and widely disseminated. There has been time for all concerned to examine the text and time to react to our major proposals.

This report has now been buttressed by an additional 1,100 pages of panel studies, and I recommend these most strongly to those of you who have a concern for specific areas. This is the background, this is the foundation upon which we based our conclusions.

The report itself, "Our Nation and the Sea," presents an array of recommendations on the tremendously diverse aspects of marine and

environmental problems. It is inconceivable that all these recommendations will be greeted with unanimous approval. The subject is too complex, there are too many conflicting interests which have grown up over the years, there is too long a history. But we have tried to meet each issue squarely, to offer our own best judgment of the wisest course to follow, however difficult.

Rather than just present alternatives, we have tried to make the best choice we could, feeling that we would serve you best in that fashion.

Over the weeks which have intervened since the release of the report, comments from members of the oceanographic community and by the professional press have been extraordinarily favorable, notwithstanding differences of opinion on specific points, as might be anticipated and is proper, and we have been amazed and enormously gratified by the evidence of support. We shall have accomplished our purpose, the purpose foreseen by the Congress in establishing the Commission—in which this committee had a predominant part—if only in due course this Nation can move from an era of study and discussion to one of organized effort with plans and funding of a range and magnitude to match needs and opportunities.

Gentlemen, rather than consume your time this morning with a lengthy summary, may I refer you to a statement on the highlights of the Commission report which was prepared for an informal meeting of the subcommittee on January 27, 1969, and entered into the record on that day. In these brief introductory remarks of my own, however, I should like to comment on the general character of our approach.

The Commission recognizes very clearly that the key to an effective use of the sea lies with science and technology. The report opens, in fact, with a discussion of the need to develop technical capabilities—the capability to move under the surface at any depth—to do productive work—to gain access to the furthest reaches of the ocean bottom—in short, to establish the technical ability to carry out any task.

We have much to say on the role of basic science and the need for continuing support of a selected number of national laboratories.

There is an excellent presentation, I believe, of the concept of fundamental technology to serve a wide range of industrial interests. Our panel on technology under Mr. Perry has put forward a most imaginative proposal for a series of national projects to focus engineering development and to impart a sense of priorities.

Yet this is not primarily a report on marine science and technology. It is a report directed towards the needs of people—and I cannot emphasize this point too strongly at this time—towards the vast resources, living and mineral, which await our exploitation; towards the abuses of technology which threaten the quality of our environment; and towards the consequences of a national failure to take action now. Science and technology are the principal means to these ends, and we have endeavored to treat them within the more comprehensive framework of economics, political realities and necessities, and management.

It is in this respect, I believe, that our report differs most markedly in character from those that have gone before. And it is only such an approach that leads one to the conviction that this extraordinary but coherent complex of problems, encompassing the resources of the oceans, the preservation and use of our shores, the pollution of our

lakes, and the monitoring and control of our global environment, must now rank high among those matters with a claim to our most urgent attention.

May I just interject here that at a time when our country is beset on all sides with enormously important and baffling problems, the list of which, is well known to you all, questions may naturally arise about the priority that should be given to marine affairs.

The point that we are most anxious to make to you and which I think that the public must understand is that although indeed our recommendations represent an investment for the future, they relate to immediate problems affecting our people, our shores and waters and that efforts toward their solution should not be deferred.

The Commission has made more than 100 recommendations in response to its mandate. Some call for administrative action. Others can become effective only through legislation. They relate to a national plan, and we recognize the need for time and for funds. But there is one step which we are convinced *must* be taken promptly if this Nation is to move forward effectively in its use of the seas.

It is our view that the goals set forth so clearly by the 89th Congress in the preamble to the Marine Resources and Engineering Development Act of of 1966—namely, the building of a strong truly national program—are to be achieved only through a major Federal reorganization in the domain of marine affairs. We recommend the creation of a new independent agency of government, reporting directly to the President. We suggest that it might be called the National Oceanic and Atmospheric Agency.

There is no need, gentlemen, for me to dwell here on the history of marine activities over the past two centuries—a history which in the Federal Government has led to a fragmentation and scattering of responsibilities among some 20 or 30 departments, bureaus, and agencies, a fact that has been commented on by everyone who has approached this field seriously. Many of these activities relate only marginally to the parent department. And this fragmentation and diffusion are inescapably reflected in the relevant committees of the Congress.

The Commission began its task without prejudging the issue, without bias or preconceived views, agreeing that a plan of organization should rightly emerge out of the ultimate needs and concept of the program itself. We should determine first what ought to be done, and only then decide how to do it.

At an early stage we rejected the idea of consolidating every single marine and atmospheric function into one massive agency.

We have indeed endeavored in the clearest terms to support the needs of a strong, effective Navy, and we recognize that programs in marine science and engineering carried out by the Navy itself are essential to that objective.

The Department of the Interior, though primarily a land agency, has activities that border on the marine—the geological survey, fresh water management, and national park and wildlife conservation.

The National Science Foundation, as we all know, supports marine and atmospheric science as part of its basic mission to advance education and research.

But, apart from these—step by step, the argument for the establishment of a strong locus of effort, with adequate authority and adequate resources, with a capacity to take major initiatives and follow through, became overwhelmingly persuasive.

As one proceeds through the report of the Commission, the logic of that argument, I think, develops of itself.

It rests upon our need to create through science and engineering an expanding array of capabilities.

It relates to the sponsoring of a plan of national projects.

It reflects the urgency of establishing before it is too late a program for the systematic management of our coastal zones and to forestall the continuing erosion of our shores and the pollution of our estuaries.

It meets the need for exploration and research that are essential to the productive use of the seabed and to the rehabilitation of our fisheries.

It recognizes the environmental unity of land and sea and atmosphere and the future of monitoring, prediction, and control.

To all users of the marine environment, it would provide essential services, including navigation, mapping, and charting.

As I have gone through these recommendations, you have seen in effect, really, the plan of the report itself, how it developed, how we chose in the end to present our case.

At the outset, we propose the transfer of certain existing agencies to form the nucleus of the new National Oceanic and Atmospheric Agency. These would include the U.S. Coast Guard, now within the Department of Transportation; the Bureau of Commercial Fisheries, Department of Interior; the Environmental Science Services Administration, Department of Commerce; and the U.S. lake survey of the Army Corps of Engineers. In addition, NOAA, as it has been called, would assume responsibility for the national sea grant program, the National Oceanographic Data Center, those programs of the Bureau of Sport Fisheries which relate particularly to marine and anadromous fisheries, possibly also in due time the National Center for Atmospheric Research and support for the U.S. Antarctic research program.

But the spirit of our intent is one of building, not of reshuffling. The design of this new civil agency has been governed by the dimensions of the task that lies before us. We have proposed only such transfers as will manifestly contribute to the achievement of our stated goals. And we are convinced that whether it be the Coast Guard or ESSA, the Bureau of Commercial Fisheries or the sea grant program, each will itself gain in strength and in effectiveness. Each will find its own mission broadening and deepening. Out of unity will come a new coherence of effort, a sharing of resources, and a sense of common interest and purpose.

The whole idea here is one of mutual reinforcement, of expanding the capabilities of each one of these elements, and making possible a wider use of their resources. We are not pretending that this will reduce the costs. We do believe that we will gain enormously in the effectiveness with which the larger task we have laid out before you will be accomplished.

The deliberations of this Commission have been marked by a particular concern for the encouragement of private investment enterprise in exploration, technological development, marine commerce, and the

economic utilization of marine resources. To this end, we believe that the maintenance of a free interflow of information and ideas among scientists in the universities, the leaders of industry, and the responsible agencies of Government is of paramount importance. Accordingly, we have recommended that a national advisory committee for the oceans be established to advise the new agency, NOAA, and to report to the President and to the Congress on the progress of Government and private programs in achieving the objectives of the national ocean program. The members of the committee, perhaps some 15 in number, would be appointed by the President with the advice and consent of the Senate. They would be drawn from a wide range of backgrounds, professionally and geographically. As the Commission itself has been, this advisory committee would be wholly free of operating responsibilities. On the other hand, the assistance of such a body in the formulation of major programs and in the independent appraisal of progress would, we believe, be invaluable.

Gentlemen, let me assure you that we did not arrive at our conclusions lightly, and we recognize full well that such a bold redesign of the existing Federal structure will not come easily. We have heard the voices of protest and are not surprised. Anyone charged with the responsibility of a department or bureau is under compulsion to serve as a protagonist for the interests of his own domain. But the real issue here is the national interest. The very existence of the Commission expresses the intent of the Congress to develop an ocean program worthy of a great sea nation. And it was clearly for that reason that the President and the Congress turned to an independent body for an outside view of this immensely complex problem—to a commission the majority of whose members were completely detached from the inescapable loyalties and commitments that must prevail within the Government. In this endeavor we welcomed and profited enormously from the experience and knowledge of three members associated with the Federal Government at that time. But, as stated in the foreword to our report, we recognized that it was wholly proper that they should abstain from taking a formal position on the matter of organization.

I might add that one of those three members was the then Under Secretary of the Navy, Mr. Baird. I believe he now feels quite free to speak for himself on the matter, and I shall allow him in due course, if he chooses to do so, to speak from his own perspective.

Mr. LENNON. Right at that point, Doctor, would you identify for the record, and for the benefit of the members who may not recall, the other two members of the Commission identified with the Federal Government?

Dr. STRATTON. Yes, sir. Dr. Robert White, who is the Director of the Environmental Science Services Administration, and Dr. Frank DiLuzio of the Department of the Interior.

In conclusion, may I say that I think we are at the threshold of decision. This is no crash program that we present to you. Indeed, in this year of budgetary stress, I must emphasize that the incremental cost of prompt action through the creation of this agency to rationalize and consolidate our efforts will, in itself, be relatively small. Indeed, there are a number of recommendations, among those 100 to which I referred, which represent actions which can be taken immediately without large budgetary commitments and for which time is of the

essence. But a failure to meet the transcendent need for such a consolidation and the building of strength—a failure to take bold and major actions will in my own judgment be disastrous to the best interests of our country and condemn us to another decade of studies and debate.

Gentlemen, that is my formal opening statement. We are prepared to respond as best we can to your questions, and as I said earlier, I would like to refer these as much as possible to my associates here, because they will bring out different points of view. You have heard me before on this, and I am at your pleasure.

Mr. LENNON. Thank you, Dr. Stratton, for a very interesting informative, and concise statement. It is a very sincere statement with respect to your recommendations particularly as it is related to the governmental structure which I am confident is sincerely shared by the 12 members of the Commission who are not associated or connected directly with the Federal Government.

The gentleman from Ohio, Mr. Mosher, who has been interested in this from the very beginning.

Mr. MOSHER. Thank you, Mr. Chairman.

Dr. Stratton, I think you will remember that several of us in the House at the very start of your deliberations urged that the Commission produce an exciting, provocative and inevitably controversial report. Personally, I think to a large degree you have produced a report and recommendations that are provocative, yes controversial, but very useful. I am sure I speak for myself and I think I speak for the other minority members of this subcommittee in saying that we want to associate ourselves with the opening remarks made by Chairman Lennon in welcoming you here at the start of these hearings.

On page 3, and in other places in your comments this morning, you referred to the need, the crucial need to move from an era of study and discussion now to one of organized effort with adequate plans and funding of a range and magnitude to meet the Nation's needs and the opportunities in the seas.

On page 6 of your comments you make it clear that this can be achieved only through a major Federal reorganization in the domain of marine affairs. And on page 8 I note the phrase you use indicating that this reorganization must give us a capacity for major initiatives and for effective followthrough.

Now, speaking of major initiatives, I get the impression from the Commission's report that a very important initiative or a very important need for major initiatives results from the lack of fundamental technology, and that much hope for the future depends on our creating an agency or a place in the Federal Government where there will be the responsibility and the opportunity and the funding and the capacity to be an initiating center of research and development for the creation of fundamental technology in the uses of the seas. I believe I am correct, am I not, that no such center now exists, no such capacity or authorization from the Congress now exists, except as it lies in the Navy or in the Department of Defense? Your emphasis is on the need in the nondefense area, the civilian area, and would you agree with me that this is one of the very crucial things that we have to have in mind, that need for technological development capacity and responsibility located definitely in the new agency?

Dr. STRATTON. I thoroughly concur, Mr. Mosher. As we look to the future the things that need to be done will be accomplished through the development of technology, materials, and resources. This is an investment for the future. These things need to be done now. But I frankly have some personal concern that although we may acknowledge the need, we may postpone action in the belief that we can't make a major investment right at the present time. I think we must make that investment. I also say that there are a variety of other matters that relate to our total marine effort which cannot wait.

Mr. MOSHER. I do not think we can use the present budget restraints, which obviously are necessary, as an excuse for waiting to create the mechanism and to establish the authorizations and the authority to move ahead. But I think that need for authorizing new programs in research and development and in the development of fundamental technology is a prime example of one of the difficulties we face in achieving the new reorganization. I am one of those who has hoped that the new reorganization might be done best and most effectively and most quickly by Executive order using the reorganization statutes which the Congress has just renewed. But many of us now doubt that there exists in the reorganization statute sufficient authority to the Executive to create NOAA and have it embody all of the new programs that your report suggests, including this new program for fundamental technology.

Recognizing that doubt, I think that we in this committee and we on Capitol Hill must not wait to see what the Executive may do and how far the White House might go by Executive order. It seems to me that we are going to have to take a very energetic initiative here and after we have had these very informative hearings and after we have educated ourselves more completely as to the need, I hope, Mr. Chairman, that on a bipartisan basis we can get together on the necessary legislation and, in effect, take the bull by the horns and move ahead here with a legislative program that will be vigorous and adequate and that we will not wait for the Executive to act and we will not wait until the budget crisis is past.

Mr. DOWNING. Would the gentleman yield?

Is there not some discussion as to what committee would have jurisdiction of this?

Mr. MOSHER. I am sure that discussion will arise, and that is one of the difficulties we are going to have to face. I am no authority on these matters, but it seems to me thas we can introduce legislation that is based on the 1966 act which should be referred to this committee, and I hope would be referred to this committee.

At the same time, let me say this about the possibilities of an Executive order: I would hope that we could discuss with the new administration the possibility of the creation of a NOAA by Executive order which at the start would not necessarily contain the programs that require new legislative authorization. I suggest that the new agency, the basis of the new agency, the nucleus of the new agency might still be created by Executive order and then that action would make it all the easier for the Congress by legislation to add to it the new authorities that are necessary.

I realize, Mr. Chairman, that I am rather premature in discussing these tactical aspects of our problem.

Mr. PELLY. Would the gentleman yield?

Mr. MOSHER. I yield.

Mr. PELLY. Some of the jurisdictional problems which confront us here and which were referred to came, of course, with the Department of Transportation by which various committees' jurisdictions were stepped on, or they felt so at least, and indeed this very committee, the Merchant Marine and Fisheries Committee, is one of those that did not take kindly to the transfer of some of the matters that normally come before us to that department. I think the basic legislation must come over from the Administration and would probably be referred to this committee as coming under oceanography and then, in turn, we would have to invite other committees to work with us.

Mr. MOSHER. I assume that is true.

Mr. Chairman, just one more word. It is so obvious to all of us that important legislation of this sort, if it ultimately succeeds, requires a sense of urgency back of it. So often the Congress only moves when there is some great threat to the Nation, some event such as Sputnik, which stirs us, and obviously we do not have that threat at this point, at least in not as dramatic a fashion. But I suggest that we do have very clearly, and it is admirably stated in the Commission report that there is the urgency of opportunity here and of need that should give us the impetus to accomplish the difficult task before us.

Mr. KEITH. Will the gentleman yield?

Mr. MOSHER. I yield.

Mr. KEITH. Along those lines, Dr. Stratton says on pages 4 and 5:

> Science and technology are the principal means to these ends, and we have endeavored to treat them within the more comprehensive framework of economics, political realities, and management.

Political realities should be our field, but I am always willing and eager for enlightenment from the so-called private sector.

You have been talking about the political realities of this reorganization, and I wonder if we might have the benefit of your thinking as to what the political realities are.

Dr. STRATTON. That particular phrase was simply a recognition of the fact that it is not going to be easy to make major readjustments in an established structure.

May I respond very warmly to Mr. Mosher's remarks. He said very clearly, more clearly than I did, what I really think we are after. We are trying to build a capability, a resource here, that this country doesn't have at the present time. It has it somewhat in the Navy, and we are urging support of the Navy. But we need to expand this technological base in order to accomplish a larger purpose.

Now, I, too, feel individually that despite budgetary stringencies, we shouldn't wait. I think we have to move now if we are going to do it at all. We think it will contribute enormously to the effectiveness with which we accomplish the goals set forth by the Commission if we consolidate some of the existing agencies.

I think perhaps some of my colleagues might want to speak to that—Mr. Reedy, Mr. Baird, if they care to.

Mr. LENNON. I am going to take the liberty to make a brief comment on what the gentleman from Ohio has said and then we will proceed in regular order so that all the members might have an opportunity.

You have indicated your intention and your will that we proceed in a nonpartisan manner. There is no question but what this subcommittee as well as the full committee has proceeded in that way, and I think it is best evidenced by the fact that the distinguished gentleman from Ohio approached me and said that in his considered judgment, with his association and work with and observation of the splendid work that was done by Dr. Wenk and members of his staff of the National Council, they ought to be continued under the new Administration. I appreciated that statement from him and he initiated, and I joined with him in a letter to the then president-elect asking that the staff of the National Council headed by Dr. Wenk be retained. That was done.

We are very proud that that is done and I am proud of it, too.

This study in depth and this report by this Commission ought to be an inspiration to anyone who has the time to read it.

I get from your statement, Doctor, that with the many, many recommendations of the Commission it is the judgment of the 12 members of the Commission that the first thing that should be seriously considered is the Government structure or organization, I get that impression. And we must keep in mind, gentlemen of the committee, that this Commission was mandated by the Congress to make its recommendations for a Government structure or no-Government structure and, if so, what type and that they have done to the fullest extent.

Getting back to the reorganization plan, I hope, Mr. Pelly, that this can be done with a Government reorganization plan sent here by the White House. I asked the counsel for the committee and the minority counsel to research this matter and to advise Mr. Mosher and myself if in their judgment it could be done. This was before, of course, we extended the life of the reorganization plan. They advised us that it could not be done that way, both of them, in a report, and for that reason we necessarily are going to have to move with legislation.

I have not introduced any legislation as a result of this report. I thought, frankly, that in my judgment it would be inappropriate for me to offer legislation that would implement the report, that some people might think that I was trying to preempt the thinking of the committee if I did so even if I did it at their request. It is not my intention to offer legislation to implement this report in any degree until such time as we have moved substantially into these hearings and then, with the feeling that I have now I will tell you quite frankly before the hearing is over I intend to do so. I hope Mr. Mosher feels the same way, that we will act in concert just as we did when we introduced a bill to extend the life of the Council where every member of this subcommittee joined in that particular piece of legislation which had its effectiveness on the floor when it came up under suspension, as you gentlemen know. There were only two questions, both of them by good friends of mine, but probing, Dr. Hall and Mr. Gross, and I am sure that they were impressed that we had absolute agreement with that legislation.

I cannot say that we will have it in what we intend to do, but hope it can be done.

Now, the gentleman from Virginia.

Mr. Downing. Thank you, Mr. Chairman.

Again, Dr. Stratton, I want to congratulate you and your fellow commissioners on an excellent landmark report. I have one question of no great moment. How did you arrive at the name NOAA? Why not NOA?

Dr. STRATTON. This refers to the reason for including "Atmospheric" in it?

Mr. DOWNING. Yes. It sounds like it might be redundant.

Dr. STRATTON. It was to emphasize our conviction that one could not wisely isolate the problems of the ocean and land from the global atmosphere. There have been questions about the whole problem of an environmental agency. But if we were to call it an environmental agency, we would lose what this Commission was set up for, which is terribly important, the emphasis upon the oceans. We believe that it is important to recognize the coupling between the environment, the global atmosphere, and the oceans.

May I, with your permission, ask if someone here would like to comment on that?

I think, perhaps, Mr. Perry.

Mr. PERRY. We originally did call it NOA, and we realized that we left out the important part of the global envelope so we added "Atmospheric" to get the complete picture because you will never get control of the atmosphere without getting knowledge of the ocean.

Mr. DOWNING. But is that to be included in oceanography?

Mr. PERRY. Yes, very definitely. The oceans occupy 71 percent of the earth's surface, and they are the pricipal factor affecting the weather.

Mr. MOSHER. Will the gentleman yield?

Is it not true that the oceans and the earth's atmosphere are essentially part of the same system?

Mr. PERRY. Yes.

Mr. MOSHER. You cannot adequately deal with the oceans without dealing with the atmosphere. I judge that to be the point.

Mr. LENNON. How is it related to the inclusion of the Environmental Science Services Administration into this reorganization? We know some of the missions and responsibility of the Environmental Science Services Administration which are related both to the atmosphere and to the sea. I wonder if the fact that that is included in this total package is one of the reasons why we have selected the name NOAA.

Dr. STRATTON. Yes, that is correct. But the inclusion of ESSA was not simply because of its great resources but because we considered its mission to be directly related to some of the missions we were proposing for the oceans—the study of the movement and the currents of air and water and their environmental relation.

Mr. DOWNING. This is not an encroachment on the jurisdiction of the space committee in any way?

Dr. STRATTON. No, I do not believe so.

May I ask Mr. Reedy to make a comment?

Mr. REEDY. I would like to make one comment. Congressman Mosher put his finger on the basic point which is that there is a continual interaction between the ocean and the atmosphere in which each contributes to the other, a great part of the atmosphere literally being drawn out of the ocean and, of course, returning to the ocean. It affects our weather. It affects climate. It is impossible to separate oceanic research from atmospheric research.

Mr. LENNON. Would the gentleman yield, for the record?

Mr. DOWNING. I yield.

Mr. LENNON. I want to differentiate between space and atmosphere for the record. The atmosphere in terms of a layman is below what we call outer space, is it not?

Dr. STRATTON. Yes.

Mr. PERRY. Yes.

Mr. DOWNING. There is such an interaction there that you felt compelled to add the extra "A"?

Dr. STRATTON. Yes, to emphasize that point.

Mr. PERRY. It is almost a continuous system, sir.

Mr. MOSHER. Would the gentleman from Virginia yield?

Mr. DOWNING. I yield.

Mr. MOSHER. Commenting on the chairman's reference to space, I think we all recognize what he is driving at and it is certainly true there is a difference. However, you don't want to push that differentiation too far because, as the gentleman from Minnesota knows better than anyone else, the earth orbiting satellites with which we are concerned over in the space sciences subcommittee are going to be of tremendous usefulness as a tool to oceanography, to say nothing of the weather people.

Mr. DOWNING. That was the point I was about to bring out, too, that we are doing things in the space committee that have a direct relationship with oceanography and the earth resources satellites are going to be tremendously helpful and conceivably we would incorporate those in the oceanographic effort. I can see a little conflict there.

Mr. LENNON. I will have to be a referee or arbitrator here because we have four of the most distinguished members of the space committee who are prominent members of this committee. For that reason, I know that you gentlemen will take care of your situation, I am sure you will.

Mr. DOWNING. We have the chairman of that subcommittee.

Mr. LENNON. Joe Karth.

Mr. KARTH. Would the gentleman yield?

Mr. LENNON. Yes.

Mr. KARTH. As far as I am concerned, I see absolutely no conflict between what you have recommended, Dr. Stratton, in your statement drawn from a very courageous report written, I think, by very courageous members. Our earth resources satellite program, dovetails with the program that you people recommend. Wherever it does dovetail there should be no argument between the two committees of the Congress. I think it would be substantially beneath us if we did argue.

And I would just like to say, Mr. Chairman, if the gentleman would yield further, that in all my years in the Congress I do not think I have ever benefitted by a stronger, more positive, to the point and objective statement than by the statement you made today, Dr. Stratton. A statement I consider to be completely devoid of pollution or dilution or contamination from outside sources, special interest and influence, and I only hope that the Administration, the agencies of Government involved and the Congress are equal to your work.

Dr. STRATTON. I am most grateful, sir.

Mr. LENNON. I thank the gentleman for his eloquent statement for the record.

Mr. Downing. Now that that matter has been completely resolved, I will go on to other questions, but I assure you somebody is going to come back to it one of these days. But I think for the purposes of the record it is well to have this further amplified.

In your research did you find any other country in the world that has a federally-oriented oceanography program going that you could use for purposes of comparison?

Dr. Stratton. First, may I make a comment about the earlier question?

You are quite right. These two are coupled. The environment we are talking about is lower space, or inner space, and it can't be separated from upper space. But the corresponding agencies of Government are set apart one from the other. We considered our proposal in relation to NASA. I have noted on other occasions that the Commission was aware that the whole structure of the Federal Government is no doubt under examination, or will be. What we are proposing does not preclude any changes that might result. We have undertaken to identify the existing agencies and functions which, if brought together, would constitute a strong, logically coherent locus of effort.

With regard to comparable Federal organization abroad, may I ask Professor Knauss if he cares to comment on that, and Professor Crutchfield, who is very familiar with the situation?

Dr. Knauss. We didn't, quite frankly, make a very thorough study of how things are done in other countries, but at least on a cursory basis you look at the larger nations who have major marine programs, the U.S.S.R., Japan, the United Kingdom, and in no case do they have anything which is quite comparable to what we are proposing but, on the other hand, their governments are not also designed in a way that is quite comparable to what we have in the United States, too, so that I am not quite sure whether the fact that they do or do not is particularly meaningful. Actually, there is nothing quite like what we are proposing in other countries, so far as we can see.

Dr. Stratton. Except there is a consolidated effort, undoubtedly, in the Soviet Union.

Mr. Crutchfield. I was going to comment, Mr. Chairman, that even in the Soviet Union it has been reported, I think very reliably, that the same kind of difficulty in divorcing land and sea resources from agencies locking one to the sea and one to the land have arisen and in fact the same problems of overlapping jurisdiction, the same problems of inability to bring all necessary capacity to bear on problems exists in this country and in others.

I think that we would probably be safe in saying that the proposal made by the Commission would be a real innovation as far as any of the major oceanographic countries are concerned.

Mr. Downing. Thank you, sir.

I have one final question, if I may.

I am very much interested in port development and the possibility of legislation which would fund improvements for ports. In discussing it with counsel he suggested that this might possibly be within your jurisdiction. Would that come within the NOAA?

Dr. Stratton. Yes, sir. Aspects of this problem and recommendations with regard to port construction did enter into it.

Mr. Baird?

Mr. Baird. Dr. Sullivan?

Dr. SULLIVAN. Well, Mr. Downing, we spent a reasonable amount of time in looking at the importance of port development, and in particular deep ports, bulk ports related to the United States and the economic aspects here on the east coast. One of the projects, of course, is the stable platform which relates to a deep port offshore. I believe that we take the position that the United States needs this technology and needs the development of ports if they are going to participate in the further revelopment of large industrial complexes related to the ocean and must consider it when it relates to the multiple uses. One of our national projects is for the development of a prototype harbor.

Mr. DOWNING. What portion of the report is that, Mr. Baird?

Mr. BAIRD. This is in the panel 2 report. We proposed 15 national projects and the Commission accepted six, but one of the others that we proposed was the prototype development harbor which would carry out what you suggested. We had to put priorities as a Commission and it was not felt that this would qualify among the topics.

Mr. LENNON. Would the gentleman yield at that point?

Do you recall that in the Merchant Marine authorization bill there was a small amount of funding to assist ports in an effort for the turn around time for the vessels that go in to try to encourage them to get better types of cranes and so forth? I remember that we discussed that under the authorization bill.

Mr. DOWNING. I think we discussed that, but I do not think we funded it.

Mr. LENNON. They said that they were proposed under research and development if they could get the funds. I know they are interested in it and that is their prime responsibility, but this proposed governmental structure does not encompass, as you said, the priorities, but just encompasses the philosophy of getting involved in the development of those ports. I believe that is what you said.

Mr. DOWNING. That was one of the offered projects, but was rejected because of priority. I can understand that.

Mr. BAIRD. Sir, our proposal is in the six national projects. We applied the necessary funding to do that but we proposed these additional ones as NOAA got the necessary muscle and the impetus to carry out these things.

Mr. LENNON. Dr. Sullivan?

Dr. SULLIVAN. Yes, sir, and in the top document we did recommend the studies for the port. This is an imaginative thing of putting a port off the United States and includes such things as an airport off the coast. Those are imaginative projects and we did not put those in the document, but the recommendation for study is in that.

Mr. DOWNING. Thank you very much.

Mr. LENNON. Mr. Pelly?

Mr. PELLY. Dr. Stratton, would you give us the thinking of the group as far as placing an organization like the Coast Guard with its vast role, operating in Vietnam, under an independent agency of this nature?

Dr. STRATTON. May I ask Mr. Baird if he would care to comment on that?

Mr. BAIRD. Mr. Pelly, we looked very carefully at that. The Coast Guard has had a long and distinguished role in defense matters and, as you suggest Coast Guard ships and men are serving with distinction now in Vietnam. As one looks at the funding pattern of the Coast

Guard, however, you discern that about 13 percent of their total funding relates to defense and defense matters. A much greater portion of their effort relates to matters much more closely akin to functions of NOAA. It was our view, and I concur in this as a former Under Secretary of the Navy, that the defense functions of the Coast Guard could well be taken over by the Navy at no great loss in total defense capability or at no increase in cost. This involves a kind of change in the role of the Coast Guard, but it is one that we thought in the total national interest was discernible.

Mr. PELLY. Well, it seemed to me that only very recently did we give the Coast Guard any role as far as oceanography went. I think that is comparatively recent. I see someone shaking his head so possibly there I am wrong but, nevertheless, I have in mind that the Coast Guard patrols our fisheries and it has functions I guess in almost every part of the world even though there may be only a few filing cabinets in some countries. But it just seems to me that this agency possibly to some may seem better under administration policy more directly than actually coming under an independent agency.

I would appreciate any more thinking on that line because I think that point may come up and it is going to have to be answered before probably Mr. Lennon introduces that piece of legislation that he has indicated he is going to do. There will certainly be some strong feelings to the contrary.

Mr. MOSHER. Will the gentleman yield?

Mr. PELLY. I yield.

Mr. MOSHER. You are not suggesting that an independent agency is really independent of the executive, of the White House policy?

Mr. PELLY. Well, we have debated that before with the Maritime Agency.

Mr. MOSHER. It is not my understanding.

Mr. PELLY. It all depends on how it is set up but if you have certain length terms of office for commissioners, would the President have the right to remove the people directing that agency. I suppose he would.

Mr. MOSHER. NASA is an independent agency, but certainly the Administrator of NASA serves at the will of the President.

Mr. LENNON. Will the gentleman from Washington yield at that point?

Mr. PELLY. I yield.

Mr. LENNON. Mr. Baird, in your experience as Assistant Secretary of the Navy and serving as a member of this Commission, can you in any way tell us how the functions of the Coast Guard under this independent agency or its roles and missions would to any degree be reduced as to effectiveness by taking it out of the Department of Transportation and putting it into this independent agency as distinguished from taking it out of the Treasury Department and putting it into the Department of Transportation.

Mr. BAIRD. I would prefer that some of my fellow Commissioners, Mr. Chairman, talk to those points, except that on the defense issue, I feel as I stated before, many of the roles and missions and functions relate to things other than defense. They relate, as Mr. Pelly suggested, to fisheries. And Dr. Crutchfield can speak better to that than I can.

Mr. LENNON. Search and rescue is its major mission, of course. In my own mind, I cannot think of how by taking it from the Depart-

ment of Transportation, where it was not so happy to go in the first place, that its effectiveness and its utilization could be impaired to any degree by putting it in this independent agency. If some of you gentlemen want to do a little research and put it in the record on this point, I think it might be helpful to all of us. I believe you wanted to speak to the question, did you, sir?

Mr. PERRY. The Commission felt that the Coast Guard was really the guts of this new agency for the simple reason that 40,000 out of the 55,000 proposed employees would be from the Coast Guard and the Coast Guard would form the basis for the real muscle which NOAA would have. I would like to give a couple of examples. For instance, the certification of submarines or standards for underwater habitats or any of the things we do in the ocean or propose to do in the ocean can all be handled by existing employees. If they are not in NOAA you have to set up a new organization to handle this and this would be much too expensive.

Mr. LENNON. Has the gentleman suggested that in the history of the Coast Guard it has not been one of the leading agencies either in the Treasury Department or Department of Transportation, and you want to put it where it can really develop as you think it ought to?

Mr. PERRY. That is right, exactly. You are a good spokesman.

Dr. STRATTON. It has functions of Customs, which relate to the Treasury. It has functions related to transportation, although marine transportation is in a rather curiously anomalous position with respect to the Department of Transportation. These functions must continue to be carried out. It has functions in Vietnam. What we are building here is a great variety of activities that relate to the ocean, and they have to do with search and rescue, with certification, with fishing, with exploration, and so on. We already have those resources in the Coast Guard, and it is our belief that that body can be made vastly more effective and useful if it is related to all these marine functions.

Mr. PELLY. Perhaps some of the functions of Customs would be transferred to the Justice Department.

Mr. PERRY. I would like to comment on that because the Customs have to do with people trying to get things in and out of the country and if you don't have an alert Coast Guard out there it is going to be too late. The Coast Guard is the one outfit that can handle this problem because having a knowledge of what is going on in the shelf and other areas will forewarn them of any attempts to smuggle things in or out.

Dr. STRATTON. But that function wouldn't be lessened by being able to do all of these other things.

Mr. PERRY. It would be something they could do in their stride.

Mr. PELLY. Would it be possible for some of the members of the Commission to extend their remarks in the record later and give us a little more thought out and comprehensive argument as to why the Coast Guard would fit into this particular agency?

Dr. STRATTON. Beyond the statement that is made in here?

Mr. PELLY. Rather than it would get a chance to enlarge itself, because I do not think that is particularly an argument. It is to increase its usefulness.

Mr. LENNON. May I have the attention of the committee, please? I wonder if there is any member of the Commission who can identify

by page number or chapter in the report where there is a more lucid or definitive explanation as to the movement of the Coast Guard from the Department of Transportation to this agency.

I see the gentleman, Dr. Sam Lawrence. Are you about to do that now?

Dr. LAWRENCE. Yes, sir. Page 236 of "Our Nation and The Sea" introduces a 3 or 4 page discussion.

Mr. LENNON. Check that, you gentlemen of the Commission, and we will put in the record at this point without objection the explanation and if you gentlemen would want to add to it we would be delighted to have you file that for the record, too.

Without objection, we will let go in the record at this point the explanation that is found on page 236 of the Commission's report, and then you gentlemen add to it if you will.

Dr. STRATTON. We will review this and if there are points to be made there we shall add them.

(The information referred to follows:)

CONSIDERATIONS RELEVANT TO THE RECOMMENDED AGENCY TRANSFERS

A proposal to reorganize the Federal Government should not be made lightly. Inevitably for a time, it will upset existing programs and personnel. And it is difficult to be certain that any particular proposal will provide the best way to accomplish desired ends. Proponents of such proposals, therefore, should carry a burden of justification. The Commission sets forth below certain considerations which led to its principal conclusions.

COAST GUARD

The most difficult question faced by the Commission in design of a plan of organization was whether to recommend the transfer of the Coast Guard from the newly formed Department of Transportation to NOAA.

The Coast Guard today

The Coast Guard now has the duty:

To enforce or assist in the enforcement of all applicable Federal laws upon the high seas and waters subject to the jurisdiction of the United States

To administer all Federal laws regarding safety of life and property on the high seas and on waters subject to the jurisdiction of the United States, except those laws specifically entrusted to some other Federal agency

To develop, establish, maintain, operate, and conduct, with due regard for the requirements of national defense, aids to maritime navigation, ocean stations, icebreaking facilities, oceanographic research, and rescue facilities for the promotion of safety on and over the high seas and waters subject to the jurisdiction of the United States

To maintain a state of readiness to function as a specialized service in the Navy in time of war.

An analysis of Coast Guard activity prepared for the Commission indicates that of its program funding 70 per cent is related to multipurpose search and rescue, navigational, port security, and enforcement activities; 13 per cent to oceanography, meteorology, icebreaking, and other marine sciences; 13 percent to military preparedness activities; and 4 per cent to merchant marine inspection and safety. Thus, although most Coast Guard activities relate to transportation, they are similarly related to other uses of the seas. Search and rescue functions, which require 35 per cent of total Coast Guard funding, are required most commonly in support of recreational boating. Provision of aids to navigation, which requires 28 per cent of the agency's budget, is critical to the whole span of marine activities. The law enforcement activities, 7 per cent of the budget, include enforcement of fisheries and recreational boating laws as well as port security. Only in merchant marine safety and inspection are tasks solely related to transportation.

The Coast Guard's tremendous physical and manpower resources—a complement of approximately 5,400 officers and 31,000 enlisted men supported by 5,900 civil service personnel—are at the disposal of many kinds of users, responding to routine needs and grave emergencies with a high and admirable professionalism. In the broad and often dangerous reaches of the sea, the Coast Guard does just about everything but guard the coast in the military sense. In a wider sense, the Coast Guard is indeed the Nation's guardian against the hazards of marine operations, serving the entire marine community, from swimmers to petroleum explorers, in so many ways that it often is impossible to define the proportion of Coast Guard effort attributable to any one category of needs. In fact, a principal characteristic of the Coast Guard's vessel and shore station operations is their multipurpose nature. A single Coast Guard vessel may tend buoys, enforce fisheries and pollution laws, search for lost pleasure boaters, rescue endangered fishermen and their vessels, conduct oceanographic investigations, or perform other services, all within a single year.

At present, the Coast Guard is considered one of the armed services and would be placed under the U.S. Navy in case of major armed conflict. Certain Coast Guard ships are today attached to the Navy in Vietnam. There are indications that the role of the Coast Guard in national defense is changing, accelerated by the growing sophistication of military operations and weapons technology. The Vietnam experience has shown that Coast Guard elements can be detached for special service without placing the entire agency in full wartime status. Careful study is needed, because the changing relationship of the Coast Guard to national defense requirements should be reflected in its internal organization and mission.

The character of the Coast Guard itself is changing under the pressure of growing uses of the sea. The needs of marine users in addition to those of the merchant marine often strain facilities. Offshore mineral operations pose new requirements and new hazards. The tremendous growth of marine recreation has created safety and enforcement problems for the Coast Guard of a magnitude unforeseen a decade ago. Increased oceanographic responsibilities from the Arctic Ocean to the shores of Antarctica are adding still a new dimension.

The Coast Guard role in a national ocean program

The Commission believes that changes in the Coast Guard and its mission should be encouraged and accelerated by bringing it within the framework of the national ocean program to be led by NOAA. In our view, the Coast Guard represents an enormously valuable national marine resource that is at present underutilized because of traditional contsraints on its mission and lack of a proper milieu for its operations. Although it is a uniformed service, the Coast Guard's services are preponderantly civil in character, and it provides an established national sea service of great potential value for a major national ocean program.

The Coast Guard is moving in the direction of increasing its oceanographic competence; this would be accelerated greatly by placing the agency in an organization devoted to marine science, technology, and service. Within NOAA, the Coast Guard would be directly supported by a broadly based scientific and technical program which would be of great assistance to the Coast Guard in modernizing its own technical services. The basic point is that with NOAA the Coast Guard can be used to a much greater degree in a more broadly gauged role than is possible within a solely transportation context and that this can be achieved without curtailing its important transport-related functions.

The transfer of the Coast Guard to NOAA would also benefit NOAA greatly. Large-scale scientific investigations could be supported by the ships, planes and other facilities of the Coast Guard. Location of marine resources could be assisted by instrumentation on board its ships and by precise navigational aids. Tests of ocean technology and marine and atmospheric monitoring and prediction programs could utilize the Coast Guard capabilities. There could be better utilization of ship facilities in mapping, charting, and other technical services.

NOAA must have education and training facilities for orientation programs, multi-disciplinary courses, and seminars for agency executive personnel, contractors, and grantees. Under NOAA, Coast Guard Academy functions could be expanded to serve the need for the professional orientation and training of those with critical roles in managing the national ocean program. Conduct of such activities on the Academy's campus would also offer many opportunities for broadening and enriching its basic program of training career officers.

The advantages of placing the Coast Guard within NOAA could be fully realized only by a real merger. The fact that the Coast Guard is a uniformed corps does not pose unsurmountable difficulties. The Coast Guard's uniformed officers would benefit from the expanded opportunities that operations under NOAA would offer.

FISHERIES PROGRAMS, DEPARTMENT OF THE INTERIOR

The Federal Government's support of marine living resource development is at present concentrated mostly in the Bureaus of Commercial Fisheries (BCF) and Sport Fisheries and Wildlife (BSFW) of the Department of the Interior. The National Sea Grant Program sponsors some applied fisheries research. BCF's programs can be broadly categorized as:

Financial and technical assistance to industry.

Biological research on individual species of fish.

Its industry assistance activities include financial aid, technical assistance, harvesting studies and techniques, and economic analysis. Its biological research includes studies of marine finfish and shellfish and habitat investigations. The Bureau's annual budget of approximately $50 million is divided about equally between industry assistance and biological research.

The Bureau of Sport Fisheries and Wildlife is a larger organization responsible for laboratory and field investigations to develop, manage, and maintain a national system of fish hatcheries and wildlife refuges; regulate the taking of migratory birds and game; and develop a national program to provide public opportunities to understand, appreciate, and use fish and wildlife resources. The emphasis on wildlife conservation is particularly pronounced in the programs of assistance to the States, which include a small program of matching grants to the States for approved anadromous fishery projects. There is an annual expenditure of only about $900,000 for in-house biological research related to marine sport fish species.

The marine components of other Department of the Interior programs are relatively minor extensions of activities oriented to the Nation's interior. In contrast, BCF's interior interests are concentrated upon a handful of fresh water species and are minor adjuncts to its essential salt water orientation.

The rehabilitation of U.S. fisheries, which is a major Congressional objective, depends upon good sea science and new, improved marine technology to define, locate, manage, and harvest the living resources of the sea. Fisheries research involves physical and chemical oceanography and marine geology and biology. Modern marine technology, including advanced instrumentation, deep submersibles, and underwater habitats must be used to advance fisheries research.

In Chapter 4, the Commission proposed a number of important actions to rehabilitate the U.S. fisheries. The many-sided aspects of these proposals require that they be concentrated within NOAA.

The Commission concludes that the Federal programs relating to marine and anadromous fisheries should be managed within a single administrative structure, as was the situation prior to the creation of the separate bureaus for commercial and sport fish in 1956. The separation has created more problems than it has solved. Integrated plans are now necessary to save some species threatened with decline. Both sport and commercial fishing interests should participate in research and management plans. The combination of marine commercial and sport fishing functions in NOAA will best accomplish these objectives.

Commercial fishing sometimes conflicts with sport fishing. Some species are valued by both groups, but other species are of either sport or commercial interest. Sport fishermen become commercial fishermen when they sell some or all of a catch to dealers or restaurants.

BSFW laboratories for study of marine and anadromous fisheries are separate from its other facilities and conduct much valuable research. An excellent program conducted by BSFW's Sandy Hook Marine Laboratory charts the location of species by monthly temperature variations along the Atlantic coast, relying on the Coast Guard to provide temperature monitoring and photography aircraft. Such research has obvious value to all aspects of living resources development.

Aquacultural research for both plant and animal species now is conducted or sponsored by BCF and the National Sea Grant Program. Close cooperation has prevented duplication, but with the two programs under single management in NOAA, coordinated planning can take place to develop the full potential aquaculture offers.

The formation of ESSA brought under single management the U.S. Weather Bureau, the U.S. Coast and Geodetic Survey, and the Central Radio Propagation Laboratory of the National Bureau of Standards. In this way, a consolidation was effected of the U.S. Department of Commerce's programs concerned with the description, understanding, and prediction of the state of the oceans and atmosphere and the size and shape of the earth.

Like the Coast Guard, ESSA provides a great variety of services to the general public and specialized users. ESSA conducts both research and technical service programs to provide:

Weather and marine forecasts and warnings
River and flood forecasts and warnings
Earth description, mapping, and charting.
Marine description, mapping, and charting
Telecommunications and space services
A national environmental satellite system

ESSA also performs work for other agencies and non-Federal organizations on a reimbursable basis and has well-established relationships with NASA, the Department of Defense, and other agencies. It has important land responsibilities stemming from its role as the central weather, flood, seismological, geodetic, and geomagnetic agency.

ESSA would provide NOAA with a broad capability in atmospheric, oceanic, and other geophysical activities. The agency maintains a close working relationship with its counterpart organizations in other nations of the world and represents the United States in the World Meteorological Organization, which coordinates all of the atmospheric and many of the marine forecasting services for the entire world.

Under the Commission's proposed organization, ESSA would provide the base for conducting ocean surveys to map and chart the sea. By consolidation of several existing fleets of ships and aircraft, NOAA could expand its essential charting and mapping services with great efficiency in use of facilities and manpower. NOAA's obligation to survey the geology of the seabed, as outlined in Chapter 4, would fit very well with ESSA's present responsibilities in geodesy, seismology, geomagnetics, and geophysics.

Joining ESSA's monitoring and prediction capabilities with those of the U.S. Coast Guard and the Bureau of Commercial Fisheries would enable the Nation to develop and manage rationally the National Environmental Monitoring and Prediction System, as recommended by the Commission.

U.S. lake survey

The U.S. Lake Survey of the U.S. Corps of Engineers is concerned with charting and studying the waters of the Great Lakes. It undertakes:

To prepare and publish navigational charts and related materials
To study elements affecting lake levels and river flow
To advise international bodies charged with managing the use of border waters
To conduct scientific investigations of the physical aspects of fresh water
To compile maps for the Army Map Service.

All these activities, except the last, are confined to the Great Lakes and nearby navigable waters. In brief, the Lake Survey does in the Great Lakes about what ESSA, in part, does in the salt waters. It is a small organization with a large mission.

The Great Lakes need more concentrated attention than the Lake Survey alone can provide. The U.S. Coast Guard is active in the Great Lakes, and its resources in the region are much greater than those of the Lake Survey. ESSA and BCF have strong capabilities which should be brought to bear on Great Lakes problems. Combining the capability of all four under NOAA would permit efficient and expeditious accomplishment of the intensified work warranted by the importance of the Great Lakes as a national resource.

Sea grant program

Under its broad legislative mandate, the National Sea Grant Program has already launched a number of valuable programs in a variety of marine areas. The Commission has recommended that the Sea Grant Program be the vehicle

to support the Coastal Zone Laboratories. It could be the means of support of the recommended University-National Laboratories. The full role of the Sea Grant Program will have to be evaluated by the new agency.

The transfer of the Sea Grant Program to NOAA would not impair the National Science Foundation's (NSF) capabilities to perform its normal functions of research and science education support. However, it would enable NOAA in conjunction with its other functions to sponsor a wide range of highly useful applied marine science and training activities in cooperation with universities and industry.

INSTITUTIONAL FUNDING FOR UNIVERSITY-NATIONAL LABORATORIES

At the present time, no system exists to assure the continuity of institutional support for the Nation's major marine science laboratories. Informally, NSF and the Navy's Office of Naval Research (ONR) have assumed a commitment to assist in providing the funds necessary for their operation. In Chapter 2 the Commission has recommended adoption of a more systematic way to support university laboratories at levels appropriate to the needs of big science and to accelerate research on the problems of the coastal zone. Proposals for University-National Laboratories and Coastal Zone Laboratories call upon NOAA to support the acquisition and maintenance of major facilities and a core staff. Such institutional funding would be augmented by supplemental grants and contracts for specific projects from any Federal agency or private source.

The National Science Foundation bears principal responsibility for university support and should continue to do so through strengthened programs and increased funding. NSF now also provides block funding for oceanographic vessels but, except under the Sea Grant Program, has not otherwise given institutional support for broad marine programs. The Commission would place responsibility for institutional support of University-National Laboratories in NOAA. This should free NSF to use its limited funds to support project research activities.

The Office of Naval Research has also been a major source of support for marine science, and particularly for the large ocean laboratories. Like NSF, ONR has supported ships and operations (though not with block funding) and has assisted universities to acquire research submersibles and special research platforms. With institutional support of the University-National Laboratories provided by NOAA, ONR could achieve an even greater diversity in its marine sciences program. NSF and ONR support of individual investigators and specific projects would, of course, continue, and the Commission urges that there be increased funding for such support.

The Commission is of the view that NOAA also should be assigned Federal responsibility to plan and coordinate large-scale oceanic scientific investigations, such as past international programs involving U.S. participation in the Tropical Atlantic and Indian Ocean expeditions and U.S. participation in the proposed International Decade of Ocean Exploration.

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

The National Center for Atmospheric Research (NCAR) is a major laboratory operated under a contract with the NSF by a nonprofit corporation representing member universities. The Center has interdisciplinary programs in the atmospheric sciences and provides extensive facilities to support scientific investigators. NCAR is an atmospheric science analogy to the University-National Laboratories proposed by the Commission, and transfer of funding responsibility for NCAR from NSF to NOAA would be a logical step once NOAA is firmly established.

Polar activities

Programs supported by NSF, Navy, ESSA, and the Coast Guard range literally from pole to pole. Most of the polar scientific programs are directed to marine and atmospheric investigations. At present, only the Antarctic program is formally coordinated within the Federal structure, but steps are underway to establish a somewhat comparable national effort in the Arctic region.

NSF now has responsibility for the support and coordination of Antarctic research. It supports two oceanographic research vessels in Antractic waters as part of this program. The Navy handles logistics for Antarctic operations, with some assistance from the Coast Guard. Federal scientific personnel for Antarctic programs are drawn principally from ESSA, Navy, and the Geological Survey, although many other agencies are also involved.

Arctic programs are chiefly the responsibility of the Coast Guard and the Department of Defense. The Coast Guard supports Arctic investigations and has international responsibility for the Iceberg Patrol in the North Atlantic; Navy submarines and surface craft have also conducted extensive Arctic investigations. Additionally, ESSA operates weather and geophysical observing programs, as well as extensive ocean mapping and charting activities.

The Commission believes that the civil aspects of polar scientific research and support would benefit from consolidation in a single agency. To achieve the consolidation within NOAA would free NSF from concern with logistic matters and release the Navy from the burden of supporting a civil program. However, it would take time for the Coast Guard to develop the logistic support capability now provided by the Navy in Antarctica, and the Commission does not believe that the consolidation of polar research activities is an immediate need of the same urgency as the other elements of its recommended organization plan.

Mr. PELLY. Mr. Chairman, I do not want to take so much time, but with your indulgence I am under the impression that one of the criticisms directed at this report came from someone in my part of the country, and maybe Dr. Crutchfield would have seen it; in other words, that this was sort of a giveaway of our seabeds to the United Nations and so forth.

I am referring to an individual who I think was chairman of the Bar Association Committee on the Law of the Sea at one time, Mr. Edward Allen, a very highly recognized man.

Would you address yourself to the question of the Continental Shelf and beyond as to any recommendation that you would make for any changes in the ownership of that?

Dr. STRATTON. Mr. Chairman, in regard to this whole international matter, I would like to make a few comments, and perhaps Dr. Crutchfield will comment.

If I may make one proposal, there are three key members who worked on the international problem, which is one of the very difficult and controversial points, as you say. Dr. Auerbach, Mr. Blaustein, and Mr. Jaworski couldn't be here today, and I have wondered in the light of the importance of these issues if perhaps at some later hearing they might appear. It is very complex.

Dr. Crutchfield, would you care to make any comment?

Dr. CRUTCHFIELD. I certainly would not wish to try to answer the question in the detail that Dr. Auerbach, Mr. Blaustein, or Mr. Jaworski could. I think the key answer to your question, Mr. Pelly, was developed very well by Dr. Auerbach at a recent meeting of NSIA here in Washington, in which he pointed out that the Commission report does not give away anything in any respect, a living or nonliving resource to which we had title.

Mr. PELLY. There is no such authority to give away anything, but does it recommend anything which could be interpreted as suggesting and recommending that eventually some plan would be made?

Dr. CRUTCHFIELD. I don't think any such interpretation was intended or could be made as the report is written.

Mr. PELLY. I am glad to know that. I am under the impression myself that under the 1958 convention we are given sovereignty over the Continental Shelf to the 200 meter and beyond where we can exploit it. As far as I know, we already own as far as we can exploit and nobody can take that away from us except by a vote of the House and the Senate. It cannot be done by treaty. Therefore, the Congress can be a watchdog so that no such giveaway would be done without the consent of Congress.

Do you agree with that?

Dr. STRATTON. Mr. Chairman, I hesitate to plunge in where others are much more expert, but I think it is very important that every aspect be explored. I have to note, though, that I have been convinced that that 1958 convention is not unchallengeable, that this interpretation has been thoroughly denied by very competent members of the legal profession. Really, what we are proposing is the need to clarify this and make absolutely certain where these lines lie. We are not giving away anything. We are providing access out to a depth of 2,500 meters. The consequences of failing to clarify and take action may well be the kind of situation we face today in Peru and other places, where we may have thought it was clear, but others have not interpreted it the same way.

Mr. LENNON. Will the gentleman yield at that point?

Dr. STRATTON. Am I right in these statements?

Mr. LENNON. Is that specifically referred to in the report, Dr. Lawrence?

Dr. LAWRENCE. Yes.

Mr. LENNON. Can you identify the chapter and the page?

Dr. STRATTON. We shall identify it.

Mr. LENNON. Was there a special panel created?

Dr. STRATTON. There was indeed.

Mr. LENNON. In substance, what is the length of that panel report on this particular subject matter?

Dr. LAWRENCE. I think that the question of law as to how rights under the 1958 convention adhere to nations runs 10 to 15 pages, Mr. Chairman.

Mr. LENNON. Would you identify for this record that particular panel report so that members can go back and when they read this summary of this hearing can refer specifically to those questions which give them concern, and refer to that part of the report or the particular panel report? Would you do that for the record, gentlemen, before you leave here today? I thought that would be helpful.

(The information referred to follows:)

The interpretations of the 1958 Geneva Conventions as they apply to rights to develop offshore mineral resources are treated in the report of the Commission at page 143 to 147 and in the report of the Commission's International Panel (Volume 3 of the Commission's Panel Report, at page VIII–11 to VIII–25.) In addition, a staff paper was prepared for the Commission by Mr. Bernard H. Oxman, "The Preparation of Article I of the Convention on the Continental Shelf," which deals in depth with the legislative history of the "Exploitability" provision and which is available from the Federal Clearinghouse for Scientific and Technical Information, Springfield, Virginia, 22151, Document No. PB 182100.

Mr. PELLY. Mr. Chairman, my attention has been called to the fact that actually the recommendation of the Commission is to establish goals to occupy the bed and subsoil of the U.S. territorial sea and utilize the shelf and slope to 2,000 feet and achieve a capability to explore to 20,000 feet so that I do not think anybody could say by any stretch of the imagination that that was a giveaway.

Dr. STRATTON. Mr. Chairman, you have no idea of how long we debated as to whether we should use the term "colonize" or "occupy" or "have access to." It was very carefully chosen.

Mr. LENNON. I think it important that you develop that at this point, Mr. Pelly, but for the benefit of those members who do not have

the opportunity to review this if they ultimately read the hearings it would be very helpful, I believe, if they could turn specifically to the report by chapter and page and turn specifically to a panel report by identification which might clarify other people's thinking on this matter.

Dr. STRATTON. We shall supply you with that.

Mr. LENNON. Dr. Crutchfield?

Dr. CRUTCHFIELD. As a word of clarification, I think it might be very useful to the members of the committee and others to note that the panel committee report dealing with this matter deals rather extensively with a series of alternative solutions that were offered, and the one that was offered, and I think the report is quite complete about the alternatives that were available to us.

Mr. LENNON. We are going to have the counsel review every one of these with the minority counsel and we will ask questions on it which we are entitled to do.

If the gentleman from Minnesota will permit, I am going to yield to Mr. Rogers. He came in and I asked him to wait.

The gentleman from Florida?

Mr. ROGERS. Not only have I waited, but I read the whole statement, Mr. Chairman, and I enjoyed it and your statement was excellent. I think you know that I feel very strongly, along with other members of the committee, that the Commission has done an excellent job. It has responded to the intent of the Congress in setting up the Commission, and I am concerned about the problem now of not losing momentum but proceeding with accomplishing something along the lines that the Commission has recommended.

Now, as I view the report, I do not see any organization that you have recommended be put in the new organization NOAA that is not now in existence. Is that correct?

Mr. PERRY. Mr. Rogers, we did add an Ocean Technology Development Bureau, Civilian Oceanographic Development Bureau. That is the only thing new that is not in existing agencies. We felt that that could be added by legislative action by you gentlemen after the President signed it into law.

Mr. ROGERS. I notice in the statement on page 10 that I do not see any organization that is not now presently in existence.

Mr. PERRY. That is correct, except for this Civilian Technology Department which would become a part of this.

Mr. ROGERS. Now, I have had legislative counsel also check into the reorganization powers of the President. It is my understanding that the President may bring together any existing agencies as long as there are no functions assigned to those agencies which have not been approved and authorized by the Congress. If this is so then, and I believe it to be so, I see no problem with the President presenting the reorganization plan to the Congress along the lines that you have recommended, say, leaving out any new functions at this time, and I think that was expressed also by some other members. Then the Congress can come in and expand those functions or expand any other activity that we desire to, but I think we can more rapidly accomplish our goal if we will try to impress upon the administration the necessity for them to move rapidly.

Let me ask you, has the Council asked the Commission for a meeting to discuss the Commission recommendations?

Dr. STRATTON. Yes, sir. On the 26th of February the Vice President convened the Council. I am under the impression that that is the only time that they have met as a whole. I was invited to be present and made a complete presentation. We had a discussion.

Mr. ROGERS. Has the Council been in touch with you again since that meeting?

Dr. STRATTON. Not formally; no, sir. Dr. Wenk and I are in conversation very often but not through any formal communication.

Mr. ROGERS. I was thinking of the Vice President as chairman of the Council with the acting Council members.

Dr. STRATTON. No, sir.

Mr. ROGERS. Because I have not seen any action by the Council yet in recommending to the President.

Dr. STRATTON. I am under the impression that they have not met.

Mr. ROGERS. I am of the same impression, and that concerns me because in setting up the Council this committee, along with other Members of Congress, thought of them as spearheading recommendations for the President and the executive as well as for Congress, and I am somewhat concerned that there seems to be some foot dragging on the part of the Council in carrying out the recommendations of the Commission in the form of urging that we get going. I am hopeful, Mr. Chairman, that this committee, as you have said, when they come over perhaps can explore that to see if we can do some urging to get some activity going in the executive branch. We understand that the new President must have some time to do this. I am not speaking in a partisan line. I think my colleagues know this.

I would say the same thing if it were a Democratic administration, and have been, as you may know, much more critical of the Democratic administration in the past than I have been of any Republican administration.

Mr. PELLY. Would the gentleman yield?

Mr. ROGERS. I yield.

Mr. PELLY. It seems incomprehensible that you would expect anybody to come with any firm plan on this tremendous thing in 60 days. I think you cannot rush through a thing like this or you are going to make a lot of mistakes.

Mr. ROGERS. Mr. Pelly, I realize that it will take some time. What I am saying is I have seen no action on the part of the Council to urge the recommendation of an agency. The report goes far beyond the agency, as I am sure you know. The agency is what the Federal Government should do and what action it should take. I think the quickest and fastest way is to get the executive to move. We can discuss this for centuries and we will have the Department of Defense say, "I don't think the Coast Guard ought to be moved," or we will have Interior, and this is possible and I understand that, but what I am saying is that the Commission has blueprinted the action. They have studied it for 2 years. What we want is some action. They have recommended action and I hope that this committee, and I certainly plan to as a member, will see if we cannot get some action.

Now, I think you were right in recommending the Coast Guard as the agency that you are building around in the new agency. The fact that they may have some defense responsibilities in Vietnam does

not concern me too much because the Department of Transportation is not the Department of Defense and their present housing does not necessarily lend toward those few duties that they are performing in Vietnam and doing very well. That does not concern me too much.

What about now the National Advisory Committee? Do you think it is well for us to go ahead and proceed with that until we decide whether we are going the route of a governmental reorganization or a legislative act?

Dr. STRATTON. That came out of your panel, I believe.

Mr. LENNON. Will the gentleman yield at that point?

Mr. ROGERS. Yes.

Mr. LENNON. I think it should be made crystal clear that the motivation behind the unanimous judgment of the committee to extend the life of the National Council for a period of 1 year after July 1 I believe, Mr. Rogers, was as a holding policymaking intergovernmental related agency or council to coordinate all of the activities that were involved and hopefully during that period of a year we could by legislation or by executive reorganization plan implement this report.

Mr. ROGERS. Yes. I understand that. What I am saying is the advisory committee that has been recommended which goes beyond the governmental basis, should we think of moving on this without waiting for a governmental reorganization plan?

Mr. PERRY. Mr. Rogers, we felt that the package ought to be all sold at once for this reason: That the National Advisory Committee on the Oceans principal function or one of its principal functions was to advise NOAA and the President and make a report to the public on the success or failure of NOAA and if there is no NOAA there is really no point in getting all steamed up about it. It would be difficult for the Council to serve that function because the Council is made up of government members and the National Advisory Committee on the ocean would have very much the same functions as the original NACA in which you get a transfer of information from industry to advise NOAA, on where industry is capable of helping it. The two are really knit very closely together and we feel should be passed at one time.

Mr. ROGERS (presiding). Thank you very much.

I commend the Commission, each of you, for the excellent job. It has been most helpful. I hope that you will help us and I am sure you will and mobilize some opinion for action now. This is what I want to see.

Mr. Keith?

Mr. KEITH. Thank you. I must apologize, Mr. Chairman, for leaving the committee rostrum and going down to ask a question. I wanted a little background on a question which I am going to ask. As we try to develop national programs that reveal the secrets of the ocean and the atmosphere and space, we are going to have a hard time allocating resources to develop these other resources both in manpower and materiel.

I noted that you elaborated, in answer to an earlier question that was asked as to what other countries have done. Have they established such an agency as we contemplate? And the answer was generally in the negative.

You pointed that Russia had done something similar. Mr. Rogers and I went to Russia and highlighted in our report some of their progress in this field which besides being scientific and technical was also

organizational. They have a committee, as I am sure you know, on science and technology and they operate through a committee system somewhat different from our Cabinet kind of operation. It seems to me that you wouldn't lose your identity as a commission and the problem of oceanography wouldn't be downgraded any further than it has been if there was a Secretary for Science and Technology who could make recommendations to the Congress and to the executive branch.

Could you tell me the nature and extent of any discussions concerning the alternative approaches, namely, instead of an executive agency of which there are numerous ones, Committee on Purchases of Blind-Made Products, for example, right alongside of the Civil Service Commission and CAB. This agency that would be established would depend a great deal upon the kind of creation that it has and the kind of public support.

Did you have any dialogue within your Commission as to the relative merits of the approach that you recommended and the approach alternatively, through recommending a Cabinet member for science and technology?

Dr. STRATTON. Mr. Chairman, the answer is that we did consider that. We had some discussions about the question of a department of science and technology, an issue which has been debated here, as I know personally, since 1946 or thereabouts. We recognized that this is a possibility. We thought also about a department of the environment which has been recommended, or science and the environment. There have been suggestions of a department of industry and technology.

A variety of such proposals are in the offing. I say quite frankly, and I would rather speak personally, and the other Commission members may concur or disagree, that at first I found rather appalling the idea of coming out with a recommendation for a new agency, because I believe that we have been proliferating new agencies of one kind or another for too long a time. Again, it seems to me that reorganizing and restructuring the Federal Government is long overdue.

As you know, in recent years proposals for what might be done have been coming up stronger and stronger—some have gotten into the public journals, and a department of science and technology has been mentioned as one possibility.

In the end we came to the conclusion that this was perhaps reaching beyond our competence and our mandate. We have said that we are proposing to you the elements of an entity that we think must be brought together if we are going to do the job we ought to do for the oceans, but that a larger restructuring would not be precluded by this proposal—in other words, such an entity might one day be encompassed in a totally reorganized Department of Interior, for instance—not just a small readjustment, but a new view of land and sea.

I am not proposing this. But there are various options that are open in making a more manageable form of our Federal Government.

Whatever one does, we believe that this grouping of functions, even more important than agencies, is essential to do the job and that it can fit into a larger framework of a kind that you were suggesting.

Mr. Reedy or Dr. Geyer, would you like to comment on this?

Mr. REEDY. I would like to add one thing, Mr. Chairman, and that is that what we were proposing is an organization designed to meet

now and for the foreseeable future the needs that we believe exist right now. There is at the moment a tremendous series of problems to which this Nation must address itself.

That would include the wide field of pollution, of fisheries, of the Continental Shelf, the extraction of various minerals, and at the moment we felt that this was the most effective way of getting at it and we wanted to make it an independent agency because we did not feel that at this particular moment in time and within the governmental structure as it now exists that we would want its effort to be diluted.

Further down the road, of course, if you were to have a much larger reorganization of the Government, then it would become a totally different matter, but we felt that we had to operate within the context of the here and now, what exists as a governmental structure, what exists as a series of problems that must be tackled, and we felt that by bringing these agencies together we would have a maximum impact upon the problems that are affecting people today.

Dr. GEYER. As you recall, early in the history of the Commission we broke up into seven panels each one dealing with a major area. There was no panel on organization, this was something which would be taken up by the Commission as a whole because of its importance; but more important than that there was no thought given essentially or emphasis to worrying about the organization until we were well down the road, until we had some idea from the results of the panel reports what the national program might be in its broad framework.

Then, instead of just taking a bunch of building blocks or organizational charts of all of the Government agencies involved in oceanography and trying to shuffle them in a jigsaw puzzle; this was the other approach.

Knowing what the national program would be, that we would recommend on the basis of the work of the panel on so on, we looked at these agencies and saw which ones would be best apt to do the job and attain the objectives that we had in mind for the national program.

One other point if I may comment, Mr. Keith, is on the Russian situation as to their organization. Last February I was at the International Oceanology Conference and one program there at the entire conference was on government programs in Oceanography, and there are about seven or eight different countries that gave their programs and none of them came within the same sort of idea that we have here.

But more important, the Russian representative gave his report on the oceanographic progress and plans for his particular department for that year and for the following year, and he said that his budget the following year would be half again as much as it was the previous year and then during the question period one of the reporters said:

But is this for the entire oceanography effort of Russia or just your department?

And he said just his department, which happens to be the hydrometeorological department, and said he had no idea of what the total oceanographic effort was.

So, apparently the coordination under the system they have there is not too effective.

Mr. BAIRD. Mr. Chairman, our chairman in his earlier remarks, indicated that as a Government member of this Commission, I, along

with the two other Goverment members, abstained from associating with the other 12 members of the Commission on the organization proposals.

Since January 20 I have been a private citizen. I have made several speeches on the Commission report and I have made it a particular point, and I would like to make it a matter of record here, that as a private citizen and as one who participated in the work of the Commission I support wholeheartedly the organization recommendations of the Commission.

Thank you, Mr. Chairman.

Mr. LENNON. I thank the gentleman for his statement. It means something to all of us, I am sure.

Mr. Keith.

Mr. KEITH (continuing). This has been very helpful to me. I think that as I see your view or as I comprehend it we have a problem of developing our natural resources and may have a problem with science and technology, but the emphasis in your report is in the development of natural resources and, in your view this is the best organizational way to get at it. It has been very enlightening.

I won't take any more time because we are getting close to the opening of the session. I would like to join with the others in complimenting you, and I might say for the record, that I think that the presence on your Commission of members of the legislative branch of Government make it much more possible for the Congress and the public in interpreting the report and sustaining interest in it. I would have liked very much to have been a member of that Commission, but R.H.I.P. and my colleagues who were fortunate enough to serve on it have done an outstanding job. I am hopeful that we can implement most of your recommendations.

I would say one thing further with reference to Mr. Rogers' remarks that the executive branch should perhaps act more expeditiously on this subject. The report, I think, was transferred to the Congress at about the same time it was transferred to the President, and I look on this as a much better way of conditioning the public for action either by the executive branch or the Congress. This kind of forum is almost a condition precedent to the executive agencies' taking action.

I trust that they have scouts in the audience. In any event, I hope that they will read these remarks and be more able to take early action.

Mr. LENNON. I thank the gentleman.

Let me say I hated to impose the 5-minute rule.

The gentleman from Minnesota.

Mr. KARTH. Thank you, Mr. Chairman. I won't take my 5 minutes. I have two things really. I first of all want to associate myself with the remarks of my colleague from Florida, Mr. Rogers, as well as others and express the desire to get moving and take some action on all of the work, study, time, and effort that has been made.

In addition to that, Mr. Chairman, there has been some talk about a possible conflict of interest between the National Aeronautics and Space Administration and NOAA if and when it becomes an agency. I frankly don't envision that, although I might say, Dr. Stratton, that we do see as a potential capability for earth resources satellites, in addition to many other capabilities, the capability of seeing down 100 feet or so in the ocean, and as a result of that having the capability to track, if you will, certain migrating fish. Also the earth resources satellites

have the capability of seeing ocean inversions or upwellings which, of course, bring up much food which again attracts fish.

So I make this statement for the record and hope NASA reads it, for whatever information comes about, through the earth resources satellite, that that information must be transferred to NOAA without any parochial bureaucracy being involved.

Mr. MOSHER. Would the gentleman yield?

Mr. KARTH. I yield.

Mr. MOSHER. I hope you agree that there would be tremendous opportunities for interaction between NOAA and NASA for a great deal of transfer of technology in the aerospace field to the oceans and ultimately in the other direction?

Mr. LENNON. Would the gentleman let me make this statement off the record?

(Discussion off the record.)

Mr. KARTH. I recognize that. Really I think there should be this interagency relationship in a very cordial and informative exchange. I see no reason why we should have any problem.

Dr. STRATTON. None whatsoever.

Mr. LENNON. Thank you, Mr. Karth.

The gentleman from California.

Mr. LEGGETT. Thank you very much, Mr. Chairman.

I want to congratulate you, too, Dr. Stratton, for your outstanding qualifications first of all, which are rather obvious, and also the report that you have made.

Our chairman has instructed us all to become thoroughly familiar with our Nation's sea. I am glad he didn't test me on it this morning, but I have had a chance to review some of your lengthy recommendations and it appears that you go from the very particular to some rather large generalities.

I am one of these vague proponents of an exploration of the sea much like we explore space and when you make your proposal, I keep trying to think back how does this compare to NASA and is it exactly the same thing?

Now, from what has been said in these questions, which have been asked and answered this morning, it appears that your primary aim is at a consolidation of four existing agencies or parts of agencies in your organization called NOAA and in the budget analysis that it indicated that in the first 5 years this would have an annual budget of about $640 or $650 million.

Let me ask you this: What do you envision as far as absorption of total manpower? You are going to take 31,000 enlisted men in the Coast Guard, 5,000 officers, and what are the other agencies involved as far as personnel goes?

Dr. STRATTON. May I ask Dr. Lawrence?

Dr. LAWRENCE. The Environmental Science Services Administration has, I believe, something in the order of 10,000. The Bureau of Commercial Fisheries is in the order of 3,500. Those three are the major contributors of personnel, although such programs as the national sea grant program have substantial funding.

Mr. LEGGETT. How about the lake survey of the Corps of Engineers?

Dr. LAWRENCE. I think they are in the order of 500 or 600, sir.

Dr. STRATTON. It is relatively small.

Mr. LEGGETT. Why didn't you include river surveys, too? Is that an identifiable segment of the Corps of Engineers, the lake section?

Dr. LAWRENCE. The lake survey does do certain surveys on rivers which feed into the Great Lakes system.

My understanding is that that is the limit of their responsibility. The Mississippi River is serviced by another organization, and it was not felt that that was a necessary component of the total ocean program, that there was no need to go beyond what was essential in order to establish the ocean program.

Mr. LEGGETT. Now, the Environmental Science section have 10,000 personnel. I assume that that is primarily our meteorological capability in the country?

Dr. LAWRENCE. The majority of the ESSA personnel, I believe, are in the Weather Bureau, yes, sir, but some fairly substantial number of those personnel, on the order of 300 or 400, are in research programs which would be quite closely associated with the oceanic research programs concerned with fluid dynamics, with the conductive processes which have a feedback relationship to ocean processes.

Mr. LEGGETT. What percentage of the Weather Bureau's activities would be associated with land and what percentage would be associated with water?

Dr. LAWRENCE. This is very hard to say because weather, after all, is a global phenomenon. Most of the weather is made over the water, the west coast weather particularly. You are from California and are aware of the need to have some capability to observe what is happening in the Pacific to have a forecast capability.

I believe the west coast accuracy is below that of the other areas of the country because we don't have the capability on the ocean as we have on the land.

Similarly on the east Georges Bank and others. So you really can't say in terms of where the weather comes from what proportion of the weather activity is land versus sea oriented. People live on land but they go out into the ocean and the Weather Bureau does have marine forecast activities.

Mr. LEGGETT. What is the total dollar cost of these agencies at the present time and what would be the cost under the consolidated agency as far as forecast?

Dr. LAWRENCE. My recollection was that the 1969 budget proposed by the President was $800 million for the components which would be brought into NOAA. Budget projections were developed by the Commission, although there are a number of assumptions that one has to understand, to understand the figure. But the outcome was that the program would esesntially double over 10 years.

Mr. LEGGETT. At the outset the cost would be the same, is that right?

Dr. LAWRENCE. The first year presumably it would be the composite of the agencies brought together plus such additional activity as maybe initiated under new legislation.

Mr. LEGGETT. Now you don't bring under the agency the Maritime Administration, do you?

Dr. LAWRENCE. No, sir.

Mr. LEGGETT. It would seem to me that the Maritime Administration, ignoring the politics for a minute and the other jurisdictional aspects, would be more akin to oceanographic development than would meteorology.

Dr. LAWRENCE. I think the chairman might want to comment on this one rather than myself, but I believe the report simply takes no position.

Dr. STRATTON. This is right. We have been asked why didn't we deal with the Merchant Marine problem, and the answer was simply that even 2 years we thought wasn't enough, that there had been a number of reviews of this question. We in no way minimize the importance of it, and the question of whether or not the Maritime Administration should be considered a function of Transportation or related to this maritime part is something which I think is still open to investigation. We did not come to a conclusion.

Mr. LEGGETT. Did your researchers come to any conclusion as to the number or amount of rubles the Soviets were expending in this similar subject area?

Dr. STRATTON. I don't believe we did, sir.

Mr. PERRY. I think that was covered in one of the council's reports. I think Dr. Wenk could give you all the information on that.

Dr. STRATTON. I think they have looked into some of that.

Mr. LEGGETT. Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Leggett.

I want to, on behalf of the committee, extend our personal appreciation for the attendance of Dr. Stratton and the eight other members of the Commission, I believe, who are here this morning along with Dr. Sam Lawrence, many of whom came great distances at a personal sacrifice. You will keep in mind that the Commission is no longer in being and these gentlemen are here voluntarily to try to assist us and help us understand and answer questions that were raised in our own minds with respect to the report. I think it is evidence of a sincere interest in their report and their work and the dedication to be sure that the Members of Congress have an opportunity to ask some questions.

I have just been advised by the chairman of the full committee that there is a strong likelihood that the hearings that we have scheduled for May 6 may have to be passed over to the seventh because of the necessity of a meeting of the full committee on some other matter related to other legislation. We are not certain about that.

As we move into the other testimony from the universities and laboratories and the private sector of our economy, we may want one of you gentlemen who is a specialist in the panels in these particular fields to sit here with us and help us answer the questions that they may ask us, and rightly so.

That is a sort of burdensome thing to ask you to do, but I hope you will be able to find it convenient to cooperate with us to that extent.

Dr. STRATTON. We will give you every help we can. The problems of travel and conflict are great, but we will just have to work them out.

Mr. LENNON. We will certainly give you the necessary time. I wish we had some travel funds to defray your costs.

Dr. STRATTON. After the 2 years we have been through, we want to see this move. We are committed to it and believe in it.

Mr. LENNON. Thank you, gentlemen.

The meeting will stand adjourned to the call of the Chair, which is now scheduled, likely, for the seventh of May, but you will be notified of course if we can work out other meetings. Thank you so much.

(The following letter was received in connection with the foregoing testimony:)

GENERAL ELECTRIC CO.,
DEFENSE PROGRAMS DIVISION,
Washington, D.C., April 29, 1969,

Hon. ALTON LENNON,
Congress of the United States,
Washington, D.C.

MY DEAR CONGRESSMAN LENNON: At this morning's hearing of the Oceanography Subcommittee the question of national programs in oceanography of other countries was brought up but in my opinion not very well answered.

I returned recently from Oceanology International '69 in Brighton, England where representatives of a number of countries made presentations on their programs. I have summarized these presentations in outline form. I am enclosing a copy hoping that you will find it useful to the work of your Subcommittee.

Respectfully yours,

Dr. F. E. ELLIOTT,
Consulting Oceanographer.

SOME MAJOR ACTIVITIES IN OCEANICS IN FOREIGN COUNTRIES

(By F. E. Elliott)

The information was abstracted from presentations given by officials of the various governments at the Oceanology International '69 in February, 1969, in Brighton, England. It is the most up-to-date information available.

In order not to burden the reader with too much detail, information is presented in the form of tables. Nevertheless, it is hoped that it will serve the purpose of giving an overall impression of activities in the marine sciences in the Western world.

Even a quick perusal of the tables shows certain common trends:

1. In all countries the bulk of the work is carried out by a number of government agencies. All but Australia have at least one coordinating agency. In other words, these countries have the same problem as the U.S. where the work in marine sciences is divided into more than a dozen agencies.
2. All countries are concerned with the resources of the continental shelf in particular with oil, gas and minerals.
3. All countries are also concerned with fisheries.

Looking at funding it becomes obvious that the U.S. is spending more (about $500 M) than all these countries combined. However, we should put these figures into the proper perspective, keeping in mind that these countries are much smaller than the U.S., have less population and less coast line. If we put the funds on the basis of Gross National Product we get a different picture. For instance the UK is spending about the same proportion of its GNP as the U.S.

AUSTRALIA

1. Cognizant organizations:
   a. Commonwealth Scientific and Industrial Research Organization, Division of Fisheries and Oceanography.
   b. Hydrographic Service, Royal Australia Navy.
   c. Bureau of Mineral Resources.
   d. Universities.
   e. Industry.
2. Coordinator: Not available.
3. Objectives: Oil, gas, minerals, fisheries.
4. Activities:
   a. Oil: considerable off shore exploration (oil producing wells since 1962) about 60% of continental shelf (1M miles) under lease.
   b. Minerals: deposits of tin, phosphorites, sand about 16% of continental shelf under lease.
   c. General: systematic geologic and bathymetric mapping of continental shelf.
5. Problems: Shortage of research vessels.
6. Employment: Not available.
7. Funding: Not available.

CANADA

1. Cognizant organizations:
   a. Canadian Royal Navy.
   b. Department of Transport.
   c. Department of Fisheries.
   d. Department of Public Works.
   e. Department of Industry.
   f. Universities.
   g. Industry.
2. Coordinator: Canadian Committee on Oceanography.
3. Objectives: Oil, gas, minerals, equipment, fisheries.
4. Activities:
   a. Oil: considerable off-shore activities about 270 M acres under lease.
   b. Minerals: maganese nodules off west coast, heavy minerals.
   c. Equipment: oil riggs, submersibles, diving equipment, vessels, instrumentation.
   d. Fisheries: Department of Fisheries operates 80 vessels, Canada second largest exporter in fisheries' products.
5. Problems: Not available.
6. Employment: About 700 scientists and engineers.
7. Funding: About $41M p.a.

FRANCE

1. Cognizant organizations:
   a. French Navy.
   b. Delegation National á la Recherche Scientifique.
   c. Centre Oceanologique de Bretayne.
   d. French Institute for Petroleum.
   e. Laboratories.
2. Coordinator: Centre National pour L'exploitation des Océans.
3. Objectives:
   a. Exploitation of the living substance.
   b. Exploitation of mineral and fossil fuels.
   c. Rational use of the continental margin.
   d. Fighting pollution.
   e. Ocean atmosphere interaction.
4. Activities:

Theme No. 1, exploitation of the living substance:

Goal No. 1: Estimate the production at the various steps of the alimentary chain.

Goal No. 2: Study and estimate the species of economic interest.

Goal No. 3: Improve the fishing methods and techniques.

Goal No. 4: Optimise the ultilisation of the products and under products of fishing (in particular those concerning fish proteins).

Goal No. 5: Acclimatize and cultivate the most interesting species (bivalves, crustaceans, fish).

Theme No. 2, exploitation of mineral and fossil fuels:

Goal No. 1: Recognise the sedimentary layers of the French continental shelf.

Goal No. 2: Prepare industrial exploitation of the sediments located on the French continental shelf.

Goal No. 3: Obtain soft water from sea water, as well as the mineral components of economic interest.

Theme No. 3, inspection and rational exploitation of the continental border and the coast:

Goal No. 1: Establish the prerequisites of an effective use of the French continental margin.

Goal No. 2: Develop the adaptation of man in the sea.

Goal No. 3: Prepare infrastructure and the necessary means for the exploitation of the French continental shelf.

Goal No. 4: Efficient action for natural resources protection.

Goal No. 5: Guarantee the rescue of men, the salvage of wrecks, the recovery of material and shiploads.

Theme No. 4, fight against pollution:
Goal No. 1: Keep the sea clean.
Goal No. 2: Clean the sea.
Goal No. 3: Foresee the danger of pollution as well as its consequence.
Theme No. 5, ocean-atmosphere interactions:
Goal No. 1: Foresee the state of the sea and of the weather, at short and long term.
Goal No. 2: Act on the meteorological phenomena to control and possibly modify them.

5. Problems: Not available.
6. Employment: Not available.
7. Funding: About $35M.

JAPAN

1. Cognizant organizations:
   a. Ministry of Agriculture and Forestry.
   b. Ministry of Transportation.
   c. Ministry of International Trade and Industry.
   d. Ministry of Construction.
   e. Defense Agency.
   f. State and Private Universities.
   g. Fisheries Laboratories.
   h. Industry.
2. Coordinator: Science and Technology Agency.
3. Objectives:
   a. Forecasting Ocean Phenomena and Weather.
   b. Effective Use of Marine Organism Resources.
   c. Development and Utilization of Sea-bed Resources.
4. Activities:
   a. Development of Continental Shelf.
   b. Study of Coastal Waves and Shore Erosion.
   c. Fisheries Research.
   d. Instrumentation.
5. Problems: No overall National Program yet (in preparation by Council of Ocean Science and Technology).
6. Employment: Not available.
7. Funding: About $8M (excluding State Universities).

UNITED KINGDOM

1. Cognizant Organizations:
   a. Ministry of Technology.
   b. Department of Education and Science.
   c. Ministry of Agriculture, Fisheries and Food.
   d. Department of Agriculture and Fisheries for Scotland.
   e. Ministry of Defense.
   f. National Research Development Corporation.
   g. Industry.
2. Coordinators:
   a. Natural Environment Research Council (for government).
   b. Advisory Committee on Marine Technology (for industry).
   c. Working Party on Sea Bed Operations (government-industry).
3. Objectives:
   a. Marine Science (basic research).
   b. Marine Technology (applied research).
4. Activities:
   a. Basic Research.
   b. Off-shore Drilling.
   c. Instrumentation, Diving and Drilling Equipment.
   d. Air-Sea Interaction.
5. Problem: Not available.
6. Employment: Not available.
7. Funding: About $31M.

WEST GERMANY

1. Cognizant organizations:
   a. 5 Federal Research Institutions.
   b. 8 University Research Institutions.
   c. 2 Private Research Institutions.
2. Coordinator: German Commission for Oceanography (Sept. '68).
3. Objectives:
   a. R&D for utilization of the living resources of the sea.
   b. R&D for utilization of universal resources.
   c. Pollution control of the sea.
   d. Studies of air-sea interaction.
   e. Studies to protect the shore against the sea.
4. Activities:
   4 oceangoing research vessels.
   10 smaller coastal research vessels engaged in fisheries research; basic research; air sea interaction; underwater habitat; instrumentation.
5. Problems: No national program as yet.
6. Employment: 200 scientists, 300 technicians.
7. Funding: Present $7.5M, $15M by '72.

(Whereupon, at 12:05 p.m., the subcommittee recessed, subject to the call of the Chair.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

WEDNESDAY, MAY 7, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE OF OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:20 a.m., pursuant to call, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. The meeting now will come to order.

Today, we resume our public hearings on the many facets of the comprehensive landmark report of the Commission on Marine Science, Engineering and Resources entitled "Our Nation and the Sea," which I hope all of you had an opportunity to read and study in depth.

Response and reaction to this report have indeed been gratifying at every level.

The Chair has been pleased to note the numbers of Members of the House who are interested in the report and have expressed their interest in various ways.

This morning we are privileged to have as our first witness, our colleague, the Honorable John B. Anderson, of Illinois.

Congressman Anderson will be followed by a witness of very unusual talents, ability, and creative energy, who is well known to many of us on the subcommittee. Let us go back in history just a little bit.

For 6 years—almost from the inception of this committee's interest in oceanography—we were privileged to have attached to our staff Capt. Paul Sherman Bauer, USNR (retired) as a very special consultant on oceanography. We were fortunate in having Captain Bauer with us until the committee reported out the bill which became the Marine Resources and Engineering Development Act of 1966.

Indeed a very successful businessman in his native Massachusetts, Captain Bauer has in recent years devoted almost full time to the cause of science. Oceanography and the other earth sciences have been his very great specialities.

He is an adjunct professor of earth sciences at American University and a consulting engineer.

His appearance here today is in the capacity of a good citizen, without representing or speaking for any special interests. With his background, I know that he will make a substantial contribution to our deliberations.

It is good, indeed, Captain Bauer, to have you with us again and our distinguished colleague and friend from Illinois, Congressman John Anderson. We will be delighted to hear from you.

Do we have copies of your statement, sir, and if so have they been distributed to the members?

26-563—69—pt. 1——7

Mr. McElroy. Yes, Mr. Chairman.
Mr. Lennon. They have.
Congressman Anderson, you may proceed.

STATEMENT OF HON. JOHN B. ANDERSON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. Anderson. Thank you very much.

Mr. Chairman and members of the Oceanography Subcommittee of the Merchant Marine and Fisheries Committee.

I am most grateful for this opportunity to appear before you today and discuss with you the report of the Commission on Marine Science, Engineering, and Resources, "Our Nation and the Sea."

When I first indicated an interest in the Stratton Commission report earlier this year more than one American expressed surprise that a Congressman from landlocked Rockford, Ill., should get excited about oceanography, but I have replied to those who have had some interest in the fact that it is not so unusual when you consider that I am located along the Rock River and my district borders on the Mississippi River and my State on Lake Michigan and the latter two bodies of water both received some attention from this Commission.

But more importantly than that I am deeply concerned about the problems and the needs of our Nation, and indeed, all mankind. We are all linked by our land-air-sea environment and we are all linked by the shrinking nature of our planet and the problems this portends.

As people become more and more numerous and as land and resources become more and more scarce, we must seek new ways to cope with this imminent crisis. I might add that at this very hour in another part of the Capitol two administration witnesses, members of the Cabinet, are testifying in connection with a war on hunger in this country and anyone who has read books like the book by Dr. Ehrlich on the *Population Bomb* knows that when we talk about the problem, the very imminent problem of having resources enough to feed the world, we are not talking about something that is merely academic.

The upcoming decade of the oceans holds great promise and high adventure in man's quest to meet his growing needs on this last great frontier on earth—a frontier spanning over two-thirds of the earth's surface yet one which we have barely skimmed.

I am happy that the Congress recognized this potential back in 1966 with the passage of the Marine Resources and Engineering Development Act calling for a national ocean program.

This committee certainly ought to be commended for the excellent leadership it has exerted and continues to exert in this area, and the Marine Resources Council and Marine Science Commission deserve our highest praise for the fine work they have done to date.

But the Commission has expired and left us with an impressive report and set of recommendations and the life of the Council has been extended for only 1 year. We must now decide what to do about the Stratton Commission report and what direction our national ocean program will take when the Council is disbanded.

Again, parenthetically I might add that another reason that has prompted my interest in testifying before this distinguished subcommittee today is that like many of you I recognize the fact that in the

past we have had many commissions who have produced very excellent reports and have voluminous reports and then after a few years we see that these reports have merely accumulated some dust on someone's library shelf and I think it would be nothing short of tragic if nothing were done to implement the basic proposals of this splendid report.

It is obvious that if we are to proceed with a national marine policy in an orderly and unified fashion, we must seek new organizational means to bring such order and unity to our efforts and therefore we need both a national and a rational approach.

For this reason, I fully endorse the recommendation of the Stratton Commission to create a new, strong and independent National Oceanic and Atmospheric Agency to coordinate and direct our national marine policy in the years ahead.

I am going to refrain from that temptation to call this a "wet NASA" as some have done since the analogy just doesn't hold water. As Dr. Wenk has pointed out, this is not a crash program, nor is it an exclusively Federal program, because it is only as you mesh together the effective cooperation and the abilities of industry, the academic world, and State and local government, only as all of these parts of our society can work together in ocean related research and development will we be able to carry out the recommendations of this report.

But at the same time there is certainly a very definite need for Federal leadership in this area, for a national plan of action based on national policy. There is a need to draw together the proliferation of marine missions scattered throughout our sprawling Federal bureaucracy.

There is a need to give some central direction and support to marine missions being conducted in industry, by universities and by State and local groupings. In short, there is a need to provide for a means for undertaking a full range of marine-related activities geared to broad human needs; or, as the 1966 act put it:

> To develop, encourage and maintain a coordinated, comprehensive, and long-range national program in marine science for the benefit of mankind.

I frankly don't see how you are going to accomplish those objectives or meet those needs without a strong, independent agency like NOAA. NOAA is central to the success of a large number of the Commission's recommendations and the Commission has therefore urged its "immediate adoption" if we are to "mobilize the resources of our Government in the most effective manner to lend strength and power to the Nation's marine commitment."

I concur with this assessment and I would respectfully urge this committee to give priority attention to the implementation of the NOAA proposal that is made in the report.

I think it is significant to note that the Commission has chosen not to adopt the wholesale consolidation of all marine activities within a single structure. It recognized that some of these programs provide close operational support to the departments and agencies in which they are presently located and should therefore not be moved.

These include the National Science Foundation's marine and atmospheric science programs, the Interior Department's fresh water, seashore and mineral resources programs, the Army Corps of Engineers' coastal and waterways programs, the Smithsonian Institution's bio-

logical and geological oceanography studies, the activities of the Office of Naval Research and the Naval Oceanographer, and the marine-related nuclear energy programs of the Atomic Energy Commission.

I think the decision to keep these out of the proposed new agencies is realistic, at least for the time being, since they are major components of their parent bodies. At the same time it is most vital that NOAA exert some type of coordination and planning role over these as the Commission has recommended.

For example, the Navy is way out in front as a leader in oceanographic research and development work, especially with the "Man in the Sea" program begun last year.

Much of this work has spin-off civilian benefits of great value to our civil marine program. I am most concerned that NOAA has some built-in mechanism to catch such spin-off benefits and to avoid duplication.

I think any legislation to create NOAA should clearly define its role with relation to civil marine programs outside the agency and provide an effective means for their coordination.

Hopefully, this will be one of the primary responsibilities of the National Advisory Committee for the Oceans under NOAA, as was proposed by the Stratton Commission, I question whether the head of NOAA could directly assume the sole responsibility for interagency planning and coordination as the Commission report has suggested.

However, there are marine programs within various Federal departments and agencies which are peripheral to the primary missions of their parent bodies and in their present form are too small to have much visibility and impact.

Instead, they breed insularity, overlap, and competition and are obstacles to an integrated national approach. These are the components which must be brought together in a strong independent agency of our Government, an agency like NOAA.

The Stratton Commission recommends that NOAA should be comprised of the U.S. Coast Guard, the Environmental Sciences Services Administration, the Bureau of Commercial Fisheries, the U.S. lake survey, the national sea grant program, the National Oceanographic Data Center, certain programs of the Bureau of Sport Fisheries and possibly the National Center for Atmospheric Research and support for the U.S. Antarctic research program.

This reorganization would shift some 55,000 employees under the roof of NOAA as well as 320 seagoing ships. The Commission is also recommending several new programs under NOAA as well as the development of an undersea capability.

The proposed bureaucratic shifts are bond to raise some controversy, especially among those who tend to jealously guard their bureaucratic preserves. This is understandable and the full implications of such shifts should receive a thorough airing, by this committee. But, as Dr. Stratton so ably pointed out in his testimony before this subcommittee last week, we must look beyond mere bureaucratic interests; in his words, "The real issue here is the national interest." We must think in terms of the human problems and needs that such an approach addresses itself to.

In the words of the Commission report:

> How fully and wisely the United States uses the sea in the decades ahead will affect profoundly its security, its economy, its stability to meet increasing demands for food and raw materials, its position and influence in the world community, and the quality of the environment in which its people live.

The time for decision has arrived. Will we turn to the sea and work together to meet its challenges and realize its potential; or will we turn our backs on the sea and reject the opportunity to improve our environment and constructively utilize its resources?

The Commission has stated:

> The Nation's stake can only be realized by a determined national effort great enough for the vast and rewarding task ahead.

Mr. Chairman, in conclusion, I urge this committee to spur the great national effort that is needed by establishing an agency capable of carrying out the mandate of the Stratton Commission.

Thank you.

Mr. LENNON. I thank the distinguished gentleman from Illinois for an interesting, informative, challenging, articulate, and eloquent statement and say that the Commission report apparently has no greater supporter than you have indicated in your remarks this morning.

I might say that the distinguished gentleman from Ohio, Mr. Mosher, asked me to express his sincere regrets and apologies that he could not be here this morning and that he was here earlier but had to appear before another committee with some people from his district.

Mr. ANDERSON. We understand that.

Mr. LENNON. The gentleman from Massachusetts.

Mr. KEITH. I thank the chairman.

I appreciate very much the time and effort that you have put into analyzing this proposal. If we are to achieve the goals of this Commission, it is going to take broad support from the inland areas, as well as from the coastal areas more immediately concerned.

It is going to take a great deal of interpretation, and there will be some arguments offered against this approach. As a matter of fact, the man who is to succeed you in the witness chair, Captain Bauer, is an authority in the field of oceanography and some of his arguments take issue with yours.

Have you had a chance to peruse his statement?

Mr. ANDERSON. No, I have not and I would certainly say, Mr. Keith, that I feel almost embarrassed to be in the room this morning in the presence of a witness that I know is in possession of so much expertise in this field as well as in being before a committee that I know has a much greater grasp of the detail in this whole area than I do.

I quite agree with the observation that the gentleman from Massachusetts has made that even those of us from inland areas have a very great and very obvious interest in seeing that the splendid report of the Stratton Commission becomes something more than just another dusty tome to add to our collection of previous Commission reports.

Mr. KEITH. With all deference to your eloquent statement, during your recital of it, I scanned the remarks that have been prepared by Captain Bauer. If you would care to comment on his remarks, I would be happy to highlight one or two of his objections for you.

He makes the point that—

One cannot separate the atmosphere from the oceans or both from the land and reasonably expect to obtain the necessary information to enable our nation to utilize advantageously, in a continuing manner, our natural resources.

He says:

The coupled system cannot be separated into parts. Studies of the Continental Shelf cannot be interpreted without a consideration of the complete air, land and sea system.

He goes on to say:

The Commission proposal is to remove certain bits and pieces from various existing departments. Those bits and pieces are supposedly the largest civilian marine oriented groups in the Federal Government. They would be placed in an agency reporting directly to the President. This would eliminate any higher echelon of management which is concerned with the total environment.

Chaos, he says, would result.

This morning in another chamber Mr. Dingell is presiding over a fish and wildlife subcommittee in which they are hearing from Dr. Margaret Mead and Mr. Stuart Udall. Their testimony concerns a select committee on the environment which would relate land, sea and air, and this in a way is a rival approach to the one we are considering.

Now, I appreciate the fact that this is a rather broad subject, but perhaps you would like to comment on this other proposal.

Mr. Anderson. Well, I have not had an opportunity to peruse the entire statement by Professor Bauer but I have just been furnished a copy and, in view of the fact that he apparently does not agree with one of the fundamental conclusions of the Stratton Commission with which I agree, I will certainly read it.

I am afraid that I do disagree. I note one statement that he makes on page 2. He has the analogy that if you carried this to the logical conclusion:

A group of enthusiasts, say, concerned with cancer research would want a separate agency reporting directly to the President concerning their problems.

I don't think that you can make that kind of a comparison with the problems to which this agency would address itself and I don't understand the statement you made about separating the sea from the environment because this agency that has been recommended by the Stratton Commission would concern itself not only with the oceans but with the atmosphere as well and the interrelation of the two.

Mr. Keith. He is also thinking of the sediments that flow from the Continent to the Shelf, and the relationship of the land to the sea.

Mr. Anderson. I tried incidentally in my statement not to be completely dogmatic.

Mr. Lennon. Would the gentleman yield to me at this point?

Until such time as this witness has had an opportunity to read or to at least hear the statement of the witness who is to follow him, I doubt not the propriety but the basis for the gentleman's real reflection and thought until he has sufficient time to consider.

I am reminded of what the gentleman says on page 2 in the bottom paragraph, "I think it is significant to note that the Commission has chosen not to adopt a wholesale consolidation . . ." and I will let you gentlemen read it from there on.

I haven't had the privilege to read Captain Bauer's statement or even glace at it as you have. If others have and ask questions before Captain Bauer has any chance to read it I think we would be here all day.

Mr. ANDERSON. I agree with the chairman that it probably would be inappropriate for me to conduct any extensive dialogue on the differences between the next witness and myself.

Mr. LENNON. We can bring you back to give you an opportunity to comment on anything that any witness has said.

Mr. KEITH. I think, Mr. Chairman, I was ill advised to attempt to get a comment on such a statement with such brief association. I was intrigued by the fact that we had two such competent witnesses with such varying responses and, knowing the talent of our colleague from Illinois, I took a chance to see how he would respond. I think he has done very well.

Mr. LENNON. He always takes excellent care of himself in any dialogue.

Go ahead.

Mr. KEITH (continuing). Thank you, Mr. Chairman.

Mr. LENNON. The gentleman from Virginia.

Mr. DOWNING. Thank you, Mr. Chairman.

I would like to add my compliments to those of my colleagues, Mr. Anderson. I think you made an excellent statement and coming from a landlocked area you are the No. 1 to advance this cause and probably will be the leader of that area of our country.

I hope so.

On page 3 you made an interesting statement, I think. You say:

I think any legislation to create NOAA should clearly define its role with relation to civil marine programs outside NOAA and provide an effective means for their coordination.

Within the past several days I have heard some members of the industry express concern about this and also, Mr. Chairman, express some concern about the fact that they are getting probably a little impatient to see what direction the Government is going to take insofar as they are concerned, and I think it is a problem, myself.

I was interested to see that you included this in your statement, too. It is an excellent statement.

Thank you very much.

Mr. ANDERSON. Thank you.

Mr. LENNON. The gentleman from Wisconsin.

Mr. SCHADEBERG. I might say that I share the enthusiasm of the distinguished gentleman from Illinois for this program and I think he gave a very excellent statement. I want to commend Mr. Anderson, for whom I share a fond respect, for his abilities and his precise and concise statements and to thank him for taking the opportunity to come before this committee.

Mr. ANDERSON. Thank you.

Mr. LENNON. I thank the gentleman.

The gentleman from Minnesota, Mr. Karth.

Mr. KARTH. Mr. Chairman, I have no questions. I want to join my colleagues on the committee in congratulating Mr. Anderson. As

another landlocked member of the Congress as far as this legislation is concerned, I want him to know that I agree thoroughly with him.

Mr. LENNON. The gentleman who is not landlocked.

Mr. POLLOCK. Thank you, Mr. Chairman.

If my distinguished colleague is a landlubber and landlocked, I think he has an excellent interest and I am delighted to see him appear before the committee this morning. I want to say that it is no surprise to me to see your presentation have the usual eloquence with which you can present a cause you believe in. We are delighted to have you on our enthusiastic team to try to get a proper effective resolution of this thing so that we can give some direction and meaning to the whole program.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Pollock.

The gentleman from Connecticut, Mr. St. Onge.

Mr. ST. ONGE. Thank you, Mr. Chairman.

Mr. Chairman, while I am not surprised at the excellence of the statement by Mr. Anderson, its conciseness and articulateness, I think his presence before the subcommittee this morning augers well for future action in the House by the subcommittee on the Stratton report and I want to congratulate Mr. Anderson.

I know how busy he is and I want to thank him for taking the time to come before the subcommittee to indicate his support and interest.

Mr. LENNON. Thank you, sir.

The gentleman from North Carolina.

Mr. JONES. I have nothing, Mr. Chairman, except to compliment Mr. Anderson for his very excellent testimony. I want to differ with you in one slight respect if I may, your influence of being unfamiliar with the subject. I beg to differ. I think you are quite familiar.

Mr. ANDERSON. Thank you.

Mr. LENNON. I wish all of you might have been present last week when Dr. Stratton and eight other members of the Marine Commission were here and made statements or at least Dr. Stratton did and four of the members of the Commission were subject to rather intensive questioning by members of the subcommittee.

I wonder if the counsel has any questions at this point.

Mr. DREWRY. Mr. Anderson, in your statement you refer to the proposed constituents of the new NOAA.

Mr. ANDERSON. Yes.

Mr. DREWRY. The Coast Guard, ESSA, the Sports and Commercial Fisheries, and so on. Of course you stated your enthusiasm for the organization. We have a problem which I have discussed every now and then with people in the Government outside of Congress and that is shouldn't there be some comparable sort of restructuring within the Congress itself.

We have one little messy situation that has existed for about 4 years right now. We have jurisdiction over the Coast Guard, Sport and Commercial Fisheries, and the sea grant program and under the rules of the House the Coast and Geodetic Survey, which doesn't exist anymore but the rule is still there, and the Interstate and Foreign Commerce Committee has jurisdiction over the Weather Bureau which doesn't exist anymore because it is now part of ESSA.

In your capacity as a veteran legislator and perhaps in your capacity as a member of the Rules Committee, do you foresee any problems in

regard to doing a little bit of surgery or restructuring within the House itself to bring, for instance, ESSA to have one place to report to instead of, as at present, to presumably have to report to three places?

Mr. ANDERSON. Well, I think I mentioned in my statement that perhaps the recommendations of the Stratton Commission for an independent agency would stimulate some conflict because bureaucratic preserves are always very jealously guarded. This is true not only of the executive branch but of the legislative branch as well.

I have another cause that is as near and dear to my heart as this cause. It is one of promoting legislative reorganization within the Congress. As you know the committee of which I am a member, the Rules Committee has recently appointed a subcommittee in an effort to draft a legislative reorganization bill and whether or not that subcommittee will feel that it can go into this question of trying to refine existing committee jurisdiction and make some of the changes that would introduce a little more rationality into the oversight function of Congress in the sense that you mentioned of having some of these agencies reporting to the Merchant Marine and Fisheries Committee rather than some other committee, I don't know.

Any judgment or projection that I might make in that regard would be premature at this point. I recognize the problem and I think it is true that we could well look at ourselves and look to some reorganization of the committee system of the Congress in an effort to adopt a better approach here, a more rational approach.

Mr. DREWRY. I think the growth in the understanding of looking at this from an environmental standpoint has probably got a lot to do with this.

About a year ago a bill having to do with the Commissioned Officer Corps of ESSA, which really was just an extension of the Commissioned Officer Corps of the Coast and Geodetic Survey was sent to the Hill and interestingly enough wound up in its initial referral with the Post Office and Civil Service Committee which has jurisdiction over none of the three constituent elements of ESSA, nor has the Post Office Committee ever dealt with any uniformed service at all.

I just wanted to raise the question because I think it is one that probably we who work in the Congress have to consider as well as our enthusiasm for reorganizing the executive branch.

Mr. ANDERSON. I think we on the Rules Committee might well mind the admonition of the gentleman.

Mr. DREWRY. Thank you.

Mr. LENNON. Thank you very much, Mr. Anderson. I hope you have the opportunity to read Captain Bauer's statement and we would like to have you comment sometime in the future at your convenience.

Mr. ANDERSON. I certainly will.

(The comment follows:)

HOUSE OF REPRESENTATIVES,
Washington, D.C., May 9, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Merchant Marine and Fisheries Committee, Longworth House Office Building, Washington, D.C.

DEAR MR. LENNON: I again wish to thank you and your distinguished Subcommittee for giving me the opportunity to testify before you on the Stratton Commission report. As you may recall, at the time of my appearance I was asked to comment on the testimony of Captain Paul S. Bauer. Not having seen an advance copy of his testimony, I was unable to do so at that time. But I have now

perused his statement and am now prepared to make a few observations for the record.

First, I can sympathize with Captain Bauer's advocacy of a comprehensive environmental approach. I would agree that it is difficult to separate the land from the sea-air environment. But as advisable as it is to move in the direction of such an approach, there is an immediate need to turn our attention to a national oceanic effort, and NOAA addresses itself to this need.

Secondly, I beg to differ with Captain Bauer's statement that NOAA "would result in the Interior Department being no longer concerned with the Marine environment!" (p. 3 of Bauer's statement) This is not the case and I attempted to point this out in my testimony. If I might quote from the Commission report: "The Commission rejected the idea of consolidating all Federal marine and atmospheric functions into a single, massive organization. Some such functions which will remain outside NOAA are integral to the agency which performs them . . . (these include) the marine-related water management programs of the Department of Interior." (p. 232, "Our Nation and the Sea")

Captain Bauer also implies that NOAA would either take over the Geological Survey or duplicate its efforts. I have been informed by a staff member of the Marine Council that neither would occur. The Coast Geodetic Survey and U.S.G.S. would complement one another and this would be assured by the interagency coordinating mechanism within NOAA.

Fourth, I am disturbed by Captain Bauer's statement that the removal of the Bureau of Commercial Fisheries from Interior to NOAA, "would be a disastrous step backwards." (p. 5) He fails to explain why the Bureau would be any less effective under NOAA. The Commission report suggests that, "The rehabilitation of U.S. fisheries . . . depends upon good sea science and new, improved marine technology to define, locate, manage and harvest the living resources of the sea," and that, "The combination of marine commercial and sport fishing functions in NOAA will best accomplish these objectives." Mention is also made of the necessity to bring aquacultural research for both plant and animal species under the single management of NOAA so that, "coordinated planning can take place to develop the full potential aquaculture offers." (pp. 239–240, "Our Nation and the Sea")

I think this approach is most vital if we are to fully realize the food resource potential of the oceans. By bringing together the aquaculture research functions of BCF and the National Sea Grant Program and by providing a focal point for industrial advances in this area, we will be moving one step closer to solving the imminent food problem our world faces.

Thank you for allowing me to comment on Captain Bauer's statement. He has provided a very provocative and controversial viewpoint which I am sure will enable your Subcommittee to proceed with a broader perspective on the problem.

With best wishes, I am

Very truly yours,

JOHN B. ANDERSON,
Member of Congress.

Mr. LENNON. Now we are delighted to have an old friend Prof. Paul S. Bauer and with his permission and consent we will insert in the record at this point Mr. Bauer's biography.

(The biography follows:)

PAUL S. BAUER

Prof. Paul S. Bauer, a native of Lynn, Massachusetts, was graduated cum laude from the Harvard Engineering School where he also received his M.S. degree in Communication Engineering and did additional graduate work in methematics and physics. He was attending Boston Law School at the time he accepted a commission in the U.S. Navy in World War II.

Prof. Bauer served in the U.S. Navy for 11 years, first as an electronics officer and later in the Bureau of Aeronautics where he was Assistant Inspector General. In 1955, he joined Project Deepfreeze I as navigation officer of VX6 and spent three months in Antarctica. Prof. Bauer retired from the Navy in 1957 as Captain USNR.

Prof. Bauer's record of civilian government service began in 1937 when he was appointed a member of the Special Recess Commission on Airports and Aviation in Massachusetts. He subsequently served as Chairman of the Advisory Board on

Aeronautics; member of the Advisory Committee on Fish and Game; and on the Special Recess Commission on Conservation, all in Massachusetts. From 1959 to 1966, he served as scientific consultant to the U.S. House Committee on Merchant Marine and Fisheries. Currently he is a consultant to the National Council of Marine Resources and Engineering Development in the Executive Office of the President.

In the world of business, Prof. Bauer organized and served as an officer of: Pine Tree Airways, Inc.; Schooner Columbia, Inc.; New England Electronics Corp.; and Electronic Devices Sales, Inc. He also served as Vice President of the R. S. Bauer Co. until sale of that company to D. L. McDonald Co. Other offices were held for the Bauer Scientific Trust, the North Shore News Co. of Lynn, Massachusetts, and the Board of Managers of Lynn Hospital, Inc.

During the period 1960 to date, Prof. Bauer served as Faculty Member ending as Adjunct Professor of Earth Science of American University, Washington, D.C. His specialty is geophysics and oceanography. He further is a licensed Professional Engineer in the District of Columbia.

Of special interest to Prof. Bauer has been the Project Surtsey, the study of the volcanic island, Surtsey, which rose from the sea in 1963 about 20 miles south of Iceland. An Honorary Founding Member of the Surtsey Research Society, in 1967 Prof. Bauer was awarded the Order of the Falcon Commander rank by the Government of Iceland for his work in this study. A film, "Volcano Surtsey" produced by Prof. Bauer has received several awards for excellence, including the International Science Film Festival "Award of Merit."

Prof. Bauer holds memberships in several professional organizations including the Institute of Electrical and Electronic Engineers, the Seismological Society of America, the American Institute of Astronautics and Aeronautics, the Geological Society of America, the American Geophysical Union, American Institute of Biological Science and others. He is the holder of several patents for his electronics inventions. His scientific publications have appeared in the Proceedings of the National Academy of Science, the Journal of General Physiology and Arbeitsphysiologie and others.

Prof. and Mrs. Bauer make their home in Washington, D.C. At present, Prof. Bauer is serving as Special Consultant to the Mote Marine Laboratory, Sarasota, Florida and is a member of its Board of Directors.

STATEMENT OF PAUL S. BAUER, CONSULTING ENGINEER, ADJUNCT PROFESSOR OF EARTH SCIENCE, AMERICAN UNIVERSITY

Captain BAUER. Thank you very much, Mr. Chairman.

If you will give me a moment I will try to get my papers in order in anticipation of the questions.

Mr. LENNON. While you are getting ready to make your statement, I notice that you are currently serving in the capacity of a consultant to the National Council on Marine Resources and Engineering Development in the Executive Office of the President.

How long have you held that position as consultant to the National Council on Marine Resources?

Captain BAUER. As I remember, Mr. Chairman, I have held that position nearly since the Council was formed. I am not, of course, in my statement reflecting the views of the Council in any way or of its staff.

Mr. LENNON. That is the reason I asked the question because I didn't know that at the present time you were a consultant to the National Council and I wondered to what extent, in the light of what has developed here this morning, you were reflecting the views of the members of the National Council including Dr. Wenk and others.

Captain BAUER. I talked the matter over with Dr. Wenk but you would have to ask him as to whether he agrees or not.

Mr. LENNON. Go ahead, sir.

Captain BAUER. Mr. Chairman and gentlemen, I am greatly honored to be allowed to appear before you as a private citizen who is extremely concerned about the future of marine sciences as well as the development of our total earth's environment and its natural resources.

My statement this morning will apply to that part of the report of the Commission on Marine Science, Engineering, and Resources which concerns itself with a proposed organization. May I say, at the outset, that I thoroughly disagree with the proposals of the Commission regarding this reorganization.

Basically, any organization which desires to effectively study an environmental system, such as planet Earth, must consider the whole as well as its parts.

One cannot separate the atmosphere from the oceans or both from the land and reasonably expect to obtain the necessary information to enable our Nation to utilize advantageously in a continuing manner, our natural resources.

For example, and this is just one of many, I might add, the structure of our continental shelves and slopes depends on sediments transported from the continent by erosion (which is due to wind and rain) through rivers to the oceans, and thence to the shelf and slope and some of these sediments go into the oceans.

Aeolian transport (by wind alone) of light dust also occurs in certain areas. Thus, one can see we have a coupled system which cannot be separated into parts. Studies of the continental shelf cannot be interpreted without a consideration of the complete air, land, and sea system.

This is a fundamental objection to the proposed organization of NOAA, which essentially combined the atmosphere and the oceans and leaves out considerations of the land. My contention is you cannot do it.

A second objection to the creation of NOAA is one of Federal management. The Commission proposal is to remove certain bits and pieces from various existing departments. Those bits and pieces are supposedly the largest civilian marine oriented groups in the Federal Government. They would be placed in an agency reporting directly to the President. This would eliminate any higher echelon of management which is concerned with the total environment.

If this were carried to its logical conclusion a group of enthusiasts, say, concerned with cancer research forgetting the other parts of the human body, would want a separate agency reporting directly to the President concerning their problems.

Chaos would result. That is why I might add, gentlemen, that we have such a thing as a Cabinet.

Whether it is organized properly or not I don't know. I will make some remarks as to that a little later. My third objection to the proposed creation of NOAA is that the assumption of the recommended responsibilities given to NOAA in the complete report, would result in the Interior Department being no longer concerned with the Marine environment!

In particular this would apply to the U.S. Geological Survey. All of its current functions would be duplicated by the Coast and Geodetic Survey which does not now have the capabilities of the Geological Survey in geology, geophysics and geochemistry.

I realize this is a strong statement to make and for a moment I should like to talk about the Geological Survey. If the committee has the opportunity, I should like to suggest they read a new publication entitled: "Marine Resources Development," published by the Department of the Interior which I have just received.

I am advised on inquiry that all of the congressmen on this committee have received such a copy. I have requested certain information in addition which I though might be of benefit to the committee, from the Survey. This is given in apendices 1 through 4 attached to my statement. I think that this information will be of value to you in consideration of my approach.

May I give a few additional facts about the Geological Survey? The USGS is one of the most prestigious scientific institutions in the United States. The current membership in the geology section of the National Academy of Sciences is 45.

One's excellence in basic science is judged to a great extent by whether or not he is a member of the National Academy of Sciences. It is the greatest honor to a scientist resulting from great achievement in his field.

The USGS has 11 of its full time staff and 12 of its part-time staff who are members of the geology section of the National Academy of Sciences. Of its over 5,000 scientific and technical personnel over 700 have the Ph. D. degree and about an equal number have received their masters degree.

Its total appropriation in the current fiscal year is approximately $90 million. In addition to the primary direct appropriation, the Survey acquires an additional $50 million through cooperative programs.

For example, $21 million is contributed to the program by more than 400 cooperating organizations at State and local governmental level which make a direct match of these appropriated Federal funds to their projects; $26 million is transferred to the Survey by other Federal agencies for reimbursable or cooperative programs. It should be realized that the program I am referring to is the total geological program for land and sea.

The plan to make NOAA (ESSA) the lead agency in geological surveys of the earth's crust covered by water is not realistic as the crust of the earth above and below the sea is continuous. Both the crustal supramarine and submarine geology must be studied together.

My fourth objection to the proposed creation of NOAA concerns the removal of the Bureau of Commercial Fisheries from the Department of Interior.

This Bureau has attained a posture of excellence in conducting large scale surveys of the marine environment not only from studies of the populations in the ocean but also from the study of the parameters (physical and chemical and atmospheric) which contribute to the ecology of marine plants and animals.

You cannot have animal or plant life without studying those factors.

The recent oceanographic surveys in the tropical Atlantic and east tropical Pacific, under the direction of the Bureau of Commericial Fisheries, were cooperative in nature and have gained worldwide recognition as standards of scientific excellence.

Several years ago, the U.S. Navy entered into a bilateral agreement with the Secretary of the Interior to jointly conduct research in the oceans to their mutual advantage. A copy of this agreement is attached to appendix 5.

Electronic links between the BCF Fishery-Oceanography Center at La Jolla and the Navy's Fleet Numerical Weather Center at Monterey permit FNWC to rapidly integrate data from BCF vessels and to provide them with computer drawn sea surface temperature charts.

This has proven to be of great importance to the tuna fleet and recently won a special commendation from the Marine Technology Society. In fact, it was so good after the first year of operation that those areas that are not indicated as potential areas by these charts developed poor fishing and conversely. The tuna fleet now is convinced of the utility of this program. That is a phenomenal development in oceanography, may I say.

The Departments of the Navy and Interior are now engaged in a study to determine the feasibility of obtaining meaningful oceanographic data from satellites and the applications of these data to prediction systems for biological, physical, and chemical oceanographic phenomena.

My opinion is that to remove this Bureau from the Department of Interior would be a disastrous backward step.

I have certain recommendations to make which I believe should be considered as a constructive alternate to the recommendation of the Commission which would establish NOAA.

These are:

1. The Coast Guard should not be removed from the Department of Transportation.

Serious consideration should be given to creating in the Coast Guard, the responsibility of the operation and maintenance of all vessels (above a certain size) owned and operated by the civilian branch of the Federal Government.

This, of course, would not apply to federally owned vessels on bailment to institutions. The experience of MSTS has been so outstanding for the Navy, costwise as well as flexabilitywise, that it should be considered by the civilian arm of the Government.

2. The officer corps of the U.S. Coast and Geodetic Survey should be phased out.

These personnel should be surveyors, engineers, or scientists—not master mariners!

3. The Department of Interior should be strengthened by making it the Federal Department of Environmental Sciences by a reorganization as follows:

(*a*) Transferring the Weather Bureau to the Department of Interior from the Department of Commerce.

The Weather Bureau is the only lacking element of the total environment under the cognizance of the Department of Interior; and

(*b*) Transferring to the Department of Interior, the Coast and Geodetic Survey and combining it with the Geological Survey.

4. ESSA should be abolished and its radio propagation functions transferred elsewhere, probably back to the Bureau of Standards whence it came.

5. Those functions not concerned with resources and environment should be transferred out of the Department of Interior.

My thinking as expressed in my remarks is not unique to me. May I call attention to an editorial by Ross L. Shipman on page 9 of the March 1969 issue of the American Geological Institute's publication "Geotimes." I believe you have copies of this publication.

Mr. Chairman, I request that the editorial on page 9 be placed in the record.

Mr. LENNON. Without objection, it is in the record at this time.

Captain BAUER. Thank you, sir.

(The editorial follows:)

[From the Geotimes, March 1969]

ENVIRONMENTAL SCIENCES

Man's future is directly related to his wise use of natural resources and to the protection and improvement of his environment. This should be a primary concern of governments: Federal, state, and local.

The Federal government's responsibility for natural resources and environmental studies is now in several departments and independent agencies. The Department of the Interior, which has the prime interest in this area, includes the U. S. Geological Survey, Bureau of Commercial Fisheries, Water Pollution Control Administration, Fish & Wildlife Service, National Park Service, Office of Coal Research, Office of Minerals & Solid Fuels, Office of Oil & Gas, Office of Water Resources Research, Oil Import Administration, and Office of Saline Water. However, other departments are also involved in environmental work; they include the Department of Commerce through its Environmental Science Services Administration, which includes the Coast & Geodetic Survey and the Weather Bureau; the Department of Agriculture's Forest Service and Soil Conservation Service; the Department of Health, Education & Welfare and its Bureau of Environmental Control; the Department of Transportation's Coast Guard (with functions in oceanography). There is also an independent office for Coal Mine Safety, the Naval Oceanographic Office, and the Federal Power Commission, which regulates all natural-gas activity.

On Jan. 11, the Commission on Marine Science, Engineering & Resources recommended that the Government establish a major civilian agency for Federal civil marine and atmospheric programs and to transfer certain existing programs to the new agency. The new agency, which would be called the National Oceanic & Atmospheric Agency, would consolidate functions and prevent duplication of effort and the inherent waste of money.

To some extent, the ideas proposed by the Commission are sound. However, some functions, such as marine geology, marine biology, commercial fishing, estuarine development, and the work of the Coast Guard, are alike only in that they are 'wet' and related to the environment. The environment's relation is the primary concern. If 'wet' environmental functions are unified as recommended, unification of all environmental functions is even more important. The various functions of the Federal government should be brought together in a coördinated approach to natural resources and the environment. This is important enough to justify a department, not merely an agency, bureau or commission.

One approach might be to use the present Department of Interior under a different name, combining the environmental functions of the other departments and the independent offices into the new department, transferring things like Indian Affairs and Job Corps Coordination to the Department of Health, Education & Welfare making the Office of Territories an independent office, and putting the power administrations (Alaska, Bonneville, Southwestern and Southeastern) in the Federal Power Commission.

The new department would not necessarily increase Federal manpower or expenditure nor would it jeopardize jobs or functions. Critical efforts to protect the nation's environment while fully developing our natural resources could be better directed if all efforts are coordinated and not competitive. The changeover could be made without major disruptions.

When the Federal government demonstrates its concern for the environment, the state governments could be expected more reasonably to accept efforts to upgrade quality of water and air and to promote soil conservation, mine controls

and reclamation. Citizens could reasonably expect their state governments to establish similar environmental boards or commissions. At this writing, Colorado is reëstablishing its geological survey, and at the same time Vermont is considering making its geological survey a part of the highway department. State geological surveys should be the foundation on which the state environmental functions are built: they should not be reduced to an agency for recommendations on roadbed stability.

The need for strong Federal leadership, at Cabinet level, in the protection of our habitat is immediate. A Department of Environmental Sciences could provide an answer.—*Ross L. Shipman.*

Captain BAUER. In conclusion, I should like to say that one cannot legislate ability, drive, or foresight. One can only pray that future administrators will always be better than their forebears.

Thank you, Mr. Chairman.

The appendices are attached and I shall be very glad to try to answer questions.

Mr. LENNON. Thank you, Captain Bauer, for again an interesting, informative, challenging, and thought provocative statement.

Let me ask you, Captain, as to the editorial that you referred to. Do you have a copy of it here for the purpose of furnishing it to the Reporter?

Captain BAUER. Yes, sir, and I think each of the committee has copies.

Mr. LENNON. The gentleman from Massachusetts.

Mr. KEITH. Thank you, Mr. Chairman.

Captain Bauer, as usual you have given the committee the benefit of your years of experience in these fields. We have great respect for all your contributions to our knowledge in the field of oceanography and other environmental sciences.

If we were to set up this new Department of the Environmental Sciences which you recommend, and abolish ESSA, that would really run contrary to a policy which we adopted as a Congress when we established ESSA.

Captain BAUER. May I point out to the gentleman from Massachusetts that ESSA was established under the Reorganization Act by the President. There were no objections from the Congress. The Congress did not act except by omission either affirmatively or negatively in the creation of ESSA.

Mr. KEITH. I realize it was done under the Reorganization Act and that is the approach that we expect may be used in implementing the Marine Resources Commission's recommendations. The Congress does have the right and responsibility if it does not concur to voice its objections and make its observations. ESSA has made, it seems to me, a great impact on the scientific community, particularly as it relates to oceanography and the atmosphere.

From a practical point of view I think the course that you suggest is almost as difficult as that which faces us in acting on the recommendations of the Commission. I would be interested in your observations on that comment of mine.

Captain BAUER. If one looks at the Commission's report I think the recommendations are fine if you just leave out that NOAA does it. There are existing agencies and many of them, of course, need coordination.

The National Council has done an excellent job under that very able executive director. Dr. Wenk, in accomplishing a stimulus in the various groups that was not present before the Council was created.

However, the response to the stimulus from my observations has not been as great with the Coast and Geodetic Survey as it has with the Geological Survey and I am talking about the material in appendix 1 of their marine geology program.

Might I point out that the Geological Survey and Navy have just completed phase I of a study of the Continental Shelf, the slope and the deep ocean areas of the Gulf of Mexico.

This investigation has been going on a year and the naval vessel *Kane* together with the Geological Survey have just completed 15,000 miles of survey trek doing profiles of the deep subbottom high resolution profiles of the shallow subbottom, bottom topography, total magnetic field, sea surface salinity.

Total gravity field measurements were made in the Eastern Gulf and from June to August the *Kane* will be taking station observations of the water columns and sedimentary cores and returning in September with an AGOR to make acoustic measurements.

The Gulf of Mexico is one of the areas that is the most important for us to obtain knowledge of its structure. This was proposed by this committee some years ago to the Coast and Geodetic Survey, in fact right after the original National Academy of Science report was presented.

It has not been done but it is now being done. Does that answer your question, sir?

Mr. KEITH. No.

Captain BAUER. If you will continue, the Caribbean Sea survey is the next one.

Mr. KEITH. I would like to ask you if your observations and conclusions were conveyed to the Marine Resources Commission as they conducted their research?

Captain BAUER. I did not testify nor was I asked to testify to the Marine Resources Commission.

Mr. KEITH. Do you know of any witnesses sharing your views that did bring them to the attention of the Marine Resources Commission?

Captain BAUER. I believe the Geological Survey made a presentation.

Dr. Pecora is listed in the report as a witness. All I have to go on is the contents in the four volumes of the Commission's report.

Mr. KEITH. It was a blue ribbon commission and was sufficiently competent to seek out all variations of opinion.

Captain BAUER. That is correct.

I am quite surprised, for example, to find that they apparently stress more, some of the outstanding programs that have been going on for 2 years that I have described, especially in the satellite oceanography program which has been going on for 3 years in a joint venture between the Geological Survey, the United States Navy, the Air Force, NASA, and ESSA.

Mr. KEITH. I know that the members of this subcommittee have had a tremendous feeling of confidence in the competence and perspective of the members of the Commission, with whom we have met on many occasions.

I am glad that you have been an early witness. We are going to hear from other members of the Commission later on and other members of the scientific community. I know, for example, that Dr. Walter Orr Roberts, perhaps the foremost scientist in the field of the atmosphere wants to testify.

They will have your comments for reflection and advise us much more competently than I can, being merely an amateur in this field.

So, thank you very much, Mr. Chairman, and thank you, Captain Bauer.

Mr. LENNON. The gentleman from Virginia.

Mr. DOWNING. Thank you, Mr. Chairman.

You have certainly given us a provocative and courageous statement, Captain Bauer, and I applaud you for it. I have known you for many years and I have the greatest respect for your judgment in this field.

Captain BAUER. Thank you, sir.

Mr. DOWNING. And if my questions sound like I may disagree with you, you are probably right.

Do you think, Captain Bauer, that our present progress in the exploitation of oceanography is satisfactory? Do you think we are making proper headway?

Captain BAUER. Mr. Downing, I think that no one could ever be satisfied with progress as a general thing. I will say that I think since the creation of the Council, the National Council on Marine Sciences, and Dr. Wenk's very able direction, many of the capabilities that had been somewhat dormant in the existing structure have suddenly come to life.

I think that is true with the influence of this subcommittee following the NASCO report. I can look with a great deal of pride at the accomplishments of this subcommittee in the field of oceanography. I remember one time when I was with the committee staff we wrote a bill to establish a national oceanographic data center. This was established by executive action.

I remember we came up with the original idea—I think your counsel, Mr. Drewry, was the originator of it—of the idea of ships of opportunity. That concept is being used especially by the Bureau of Commercial Fisheries in the Department of the Interior and the U.S. Navy. The Smithsonian Institution have used them quite a bit in their researches for specialized investigation.

I remember that we had a great deal of opposition one time about instrumentation standardization and a bill was drafted by this subcommittee to establish a national instrumentation standardization center.

This was particularly brought out in testimony because of the fact that one of our large institutions found that their oxygen determinations during the International Geophysical Year were wrong.

Centers for standardization were established in the Navy and the Bureau of Commercial Fisheries by administrative action.

So the accomplishments have been continually going on. I think the last part of my statement perhaps is not strong enough but certainly somewhere in the governmental system we need someone constantly exercising pressure so that people do not get dormant sitting down where they are.

Now NOAA without that pressure will be dormant or the Bureau of Interior or the Bureau of Natural Resources. The pressure from this subcommittee has been great. The pressure from the National Council has been great.

For example, the satellite sensing program of the Navy and the Bureau of Commercial Fisheries, NASA and the Geological Survey is fantastic. When you can by aircraft flights determine where the tuna are going to be in the Pacific, I think that is a great accomplishment. Does that answer your question, sir?

Mr. DOWNING. I suppose then the answer to my question would generally be that you think the status quo is generally all right?

Captain BAUER. I think the organizational situation needs to be changed to have the total environment in one spot and it is my recommendation that it should be the Department of the Interior.

If you want to have a successful program, you have to take out everything that concerns the land and sea and atmosphere and put it in NOAA. You cannot divide it.

Mr. DOWNING. You don't see any benefit to be derived from creation of one single agency to drive forward and exploit this new frontier?

Captain BAUER. In the total environment you mean? You can't separate them, sir.

Might I point out that if you remember, Mr. Downing, some years ago we had hearings on the Northeast storm and at that time the Weather Bureau came to a joint hearing with the Navy. Dr. Reichelderfer was the coordinator of the hearings. We heard testimony to the effect that a strong low pressure area had been for 5 days some 400 miles off the Atlantic coast and no one knew anything about it. I asked Dr. Richelderfer in those hearings, "Don't we have aircraft flying over that route? Don't we have ships going through there?"

And the answer was, "Yes."

So that the source of information was there and the airlines knew it and the Navy knew it but the Weather Bureau didn't until it hit the beach.

Now, since then the Weather Bureau has become much more ocean minded and when Dr. Holloman was Assistant Secretary of Commerce for Science and Technology in the Department of Commerce he persuaded the President to form ESSA.

There is a feeling which has been apparent to me for some time that the Weather Bureau never has liked to take information obtained by the Navy, although they get all of the marine information in parallel at Suitland as well as at Monterey.

They have had the information. They do not have the capability in marine forecasting anywhere near comparable to the U.S. Navy. This is just the way it has grown. I am all for a civilian agency having the capability, but on the other hand, if the Navy has it and it is not classified, why duplicate the entire forecasting arrangement?

Mr. DOWNING. Don't I see some similarity between this effort and the space effort in the late 1950's where everybody was enthralled with this idea of exploiting space but there was no real national effort until President Kennedy decided that was one of the national goals of this country and created NASA with that goal to pursue and we did it and we are successful?

Don't you think the same thing could happen with inner space?

Captain BAUER. I concur that it should happen and that is why my recommendations to strengthen the Department of the Interior are made.

Mr. DOWNING. But your recommendations just diversify more in my opinion. Let me look at them here. You say the Coast Guard should not be removed from the Department of Transportation but that some inner organization within the Coast Guard should have a part of this responsibility.

Captain BAUER. I feel that experts, not scientists, should be ship operators.

Mr. DOWNING. Those ships could carry scientists.

Captain BAUER. Oh, yes. They would.

Mr. DOWNING. Scientists are not necessarily ship operators and you have to have both.

Captain BAUER. I agree. That is why I should like to see the responsibility placed in the Coast Guard as it is in the MSTS in the Navy.

Mr. DOWNING. Then you say that the Department of Interior should be strengthened by putting certain functions in that agency and you would abolish ESSA "and its radio propagation functions transferred elsewhere."

It seems to me that you have to be of the opinion that basically the way we are going now is satisfactory.

Captain BAUER. No, I don't think so by any manner of means. That is why I made my recommendations about strengthening the Department of the Interior.

For example, the Alaska power thing should go to the Federal Power Commission. Probably the Bureau of Indian Affairs should go elsewhere. The Department should be a department of the total environment and may I point out——

Mr. LENNON. Would you yield to me at that point? That statement intrigues me, Captain Bauer. Most of us laymen relate the Department of the Interior to the landmass in its general jurisdiction generally speaking except as related to the leasings of oil leases off the Continental Shelf.

How is the Department of the Interior now involved in the basic environmental sciences?

Captain BAUER. Through the Geological Survey. In appendix 2 are the descriptions of the projects now existing in marine geology which do not exist in ESSA.

Mr. LENNON. So when you speak of ESSA you summed that up by saying it just isn't doing anything except one thing. You mentioned one thing, and you say the radio propagation function should be transferred elsewhere; but you infer that ESSA has no capability whatever except in the field of radio propagation.

Is that the substance of what you say?

Captain BAUER. No, no.

Mr. LENNON. You say it should be abolished.

Captain BAUER. That is true. After the transfer of the Weather Bureau and the Coast and Geodetic Survey to the Department of the Interior, ESSA would be left with only the radio propagation function which certainly is not of the marine environment I should say. It has to do with the troposphere.

Mr. SCHADEBERG. Will the gentleman yield?

I think there is a good reasoning here. I share this idea that these things must be interrelated, but would you say that space has any relationship to our earth too. I mean does it have any effect on weather?

Captain BAUER. It probably does. Dr. Abbot for many years has maintained that he could forecast the weather by forecasting sun spots and the energy derived from the sun. There is no question about that.

Mr. SCHADEBERG. Then would you have suggested that we should have put the space program under the Department of the Interior?

Captain BAUER. Oh, no, of course not. You will have to draw the line somewhere. If you want to carry the totality of the environment to the point of taking in the universe, I think that is just a question of spinning your wheels.

If you confine your activities to the troposphere and below where most of the weather and, the interrelations with weather, the land and the sea occur, you will have plenty to do. That should be the closed system that you define.

If you want to be philosophical about it we should include the universe but I am trying to be practical.

For example, why is the Pacific Ocean saltier than the Atlantic Ocean. The reason is simple. It is because of the fact that the trade winds carry the moisture from the Atlantic toward the Pacific, hit the mountains of South America, cause precipitation which comes down through large rivers, the Amazon and so on of South America, and, therefore, dilutes the salinity of the Atlantic Ocean.

In the Pacific you do not have that situation. Therefore, the Pacific is saltier than the Atlantic.

So the land masses do have an influence on the oceans' structure. If we go through with the proposed widening of the sea level canal in Panama, we are liable as has been pointed out by, I believe, Dr. Van Arks of Woods Hole to change the entire atmospheric structure of the world. If we were to connect Siberia and Alaska through the Bering Straits we would change the world's atmospheric, oceanic, ocean and land environment.

Mr. SCHADEBERG. Thank you.

Mr. DOWNING. Would it have been better in your opinion to have transferred these functions to the space agency?

Captain BAUER. No, I think the space agency has enough to do to concern itself from the troposphere on. I might say there is a close coordination between NASA and the utilization of the oceans, the land and so on. They are very much interested in doing this from satellites and the current program going on, which you will see in the basic agreement in appendix 5, between the Navy and the Department of the Interior proposes and it is now going on to the determination of oceanographic parameters, variables, and so on from satellites.

This is now going on and has been for some 3 years. ESSA is not a party to this agreement.

Mr. DOWNING. Thank you very much, Captain. I think that your report here today is an interesting one and I agree with my colleague from Massachusetts in that I think it is timely. I am glad you got on at the beginning of this so that we can use parts of your testimony in questioning other witnesses.

Mr. LENNON. The gentleman from Wisconsin.

Mr. SCHADEBERG. I too, want to thank you for being here. I think this will be very helpful when we reach our later hearings.

Is it your opinion that the creation of NOAA then would slow down research or that it would be less capable of success than if these were put under the Department of the Interior?

Captain BAUER. Very definitely, sir, because of the following reasons: we already have an outstanding program going ahead in the Bureau of Commercial Fisheries with respect to the various matters that I mentioned already this morning, the space program, combined with the Navy, their capability of forecasting where a fish will be combined with the Navy's system.

If you take the Bureau of Commercial Fisheries and put it into another agency, you will not necessarily increase their capability. They are extremely capable. They are held up by funding budgetwise and also the inertia that goes with any department structure in time.

So if we have a continuation of the Council and this subcommittee keeps its jurisdiction to continually prod the various components, I see no difficulty. I think that we are making marked progress. The whole question of geological mapping is being done now, as shown in appendix 1, by the Geological Survey. This has been suggested for over 10 years by this committee and nothing was done about it, but now it is since the Council was created. So I think we are making great progress.

Mr. SCHADEBERG. Could not these various agencies cooperate or coordinate their activities with NOAA as well as with the Department of the Interior and the Department of Interior also cooperate with a new agency?

Captain BAUER. I should hope for coordination but I am very much concerned about the situation with respect to the Coast and Geodetic Survey part of E.S.S.A. Over 10 years ago they started doing a geophysical survey between the Aleutians and Hawaii.

The Navy tried 2 years ago to get the information for military purposes and the Coast Survey finally agreed to let them have it if they regarded it as confidential because the Coast Survey wanted to publish it first.

Now, 10 years after the observations were taken, the data have not been published yet. So I would hate to see a new organization started with that kind of a record as the base. That is not so with the Geological Survey. It is not so with the Bureau of Commercial Fisheries and it is not so with the U.S. Navy.

Mr. SCHADEBERG. I want to thank the gentleman for being here and I hope he comes back because I think after being able to assimilate some of this information, and coordinate our own information, it would be helpful to address some further questions to him.

Mr. LENNON. Thank you.

Mr. Karth.

Mr. KARTH. Thank you, Mr. Chairman. I agree with my colleague, Mr. Schadeberg, that it is very difficult to evaluate your testimony in just the few moments that we have, and some day I want more time, Mr. Chairman, to take a look at it.

One thing does come to mind immediately and that is the whole question of the degree of interest that an agency that has been with us for a long time, has evidenced in the past in the subject matter that we are talking about now, oceanology or oceanography.

I think it is perfectly obvious that in spite of the fact that they have been privileged to establish their own priorities over the years that they have evidenced little interest in oceanography just by virtue of the fact that the budget they submitted to the Congress has included funds of a very minor character for this purpose.

I think that is understandable, Mr. Chairman. After all, the Department of the Interior has always been land oriented as opposed to ocean and atmosphere oriented. I would think that, if we did what Captain Bauer suggested, that for all practical purposes what we would be doing is establishing a brandnew agency, except that we are calling it Initerior rather than calling it NOAA. Captain Bauer is suggesting we take out of Interior that which probably has little or no association with the environment, such as Indian affairs and other things that the witness has mentioned and bringing to Interior other sections of other agencies or departments that now, of course, are in other agencies or departments having little past association with Interior.

The fact of the matter is, Mr. Chairman, as I understand it at least, the Marine Council did try to encourage the Geological Survey to spend more funds on ocean related activities but even with this encouragement the Department of the Interior has never evidenced any great interest.

They have never really had a sense of commitment to the oceans. Had they had that sense of commitment, I suppose they would have proposed to us the type of legislation that the Congress took the initiative in passing when we created the Council and the Commission in an effort to get the show on the road, so to speak, as it relates to an oceanographic interest that this Nation ought to have.

Generally, executive agencies having that kind of an interest evidence it by proposing legislation to the Congress and in this case, of course, has obviously been lacking.

With this history of lack of interest I doubt seriously, Mr. Chairman, that Interior could convince the Congress that they ought to raise the kind of money for that agency to do the kind of jobs we think ought to be done in the field of oceanography and that all of us feel so strongly about.

I think this past fiscal year the witness' figures indicate that the budget was somewhere in the neighborhood of $140 million. I don't know how much of that total was spent on ocean related subject matters, but I have a strong feeling that it was a very slight portion of the total, maybe in the neighborhood of $5 million or so.

However, I want to join the other members of the committee, Captain, in commending you for bringing to us your personal opinions on this very important subject. I don't, as I suppose I have already indicated, however, agree with your conclusions. I feel very strongly that, if we are going to talk about the total environment as Mr. Shadeberg very ably pointed out, then we do in fact have to talk about space, outer space as well as atmospheric space, as well as the sea, and as well as the land, because there is a very direct and close relationship as the witness understands, perhaps much better than the gentleman from Minnesota does. However, we know that a good part of our total weather, Mr. Chairman, is caused by phenomena that takes place outside of the inner atmosphere for that matter even outside of the outer atmosphere, takes places in outer space; and not too long ago the feeling was that the sun spot cycle had a very direct relationship to the

weather here on earth. Now we have changed our minds and the professionals are saying that the activity of the QUESAR, for example, are causing this to be brought about more than, for example, the sun eruptions.

I don't want to pursue this, Captain, but I do disagree with your analogy so far as it relates to cancer research. Because what you are really talking about in drawing that analogy is one small portion or small segment of medical research and the establishment of a head over it reporting directly to the President.

Instead of saying that all of medical research should be brought under one head of which cancer is a small part, establish that under one head, one agency, and then report directly to the President. That makes sense and that pretty much I think is what the Commission is recommending here, that most aspects of oceanography or oceanology be brought together under one head so that we could have some direction, some emphasis conducive to an aggressive program.

I agree it may well be true that the Coast and Geodetic Survey does not now have the capabilities of the Geological Survey in geology, any more for example, than NASA had any capabilities in outer space prior to the formation of that agency. But upon being formed, they drew their personnel from other agencies in the Government, from the academic community and from private industry. NASA formed a cohesive group of professionals, the likes of which I don't think this nation has ever before seen with the exception perhaps of the Department of Defense. Had it not been for the fact that they were put under one head with a mission, with an objective, with a responsibility, there is no question in my mind that we would not have a viable space program today.

We would have a program with many different people, many different agencies all going in different directions. As I understand the report, Mr. Chairman, the commission is not alleging that, having spent hundreds of millions of dollars on oceanographic research, we have derived no benefits at all.

What they are saying is that we should have derived greater benefits and that the only way we can derive these greater benefits of course is to have a single agency with a commitment and with a direct responsibility. Hopefully as a result of our past experience, primarily with NASA, then we will better be able to reach the objectives we all seek.

I again, Mr. Chairman, want to compliment the gentleman for bringing to us his independent viewpoints, but I would want more time to study the appendices attached to the statement and of course greater time to study the statement itself.

Thank you very much.

Mr. LENNON. Thank you, Mr. Karth.

The gentleman from California.

Mr. HANNA. Thank you, Mr. Chairman.

I have been very pleased to be a part of this panel here this morning and hear your testimony.

I am struck by the fact that I think your approach is right on target, but it requires a lift factor that may give us political double hernia.

I think it is allied to a history of our country, and the whole present technology in science, which runs from Henry Ford to Robert McNamara, in which we developed a division of labor and specialists in

professionalism out of which we inherited tunnel vision and we also have wells of activity in science research and application that do not always properly interrelate.

Now, if I understand your testimony correctly, you are asking us now to look at this thing from an entirely different perspective. You speak in terms not of specific knowledge, but of relational knowledge. You talk about the ecology and interface.

I think you are right. I think we are at the point in which there are more things falling in the cracks than are really being accomplished in these tunnels or in these wells.

Is there not something of that in what you have been telling us?

Captain BAUER. Yes, sir. There definitely is.

I would have no objection if you want to take all of the total environment functions out of the Department of the Interior and combine them, but my point is that the total environment must be considered.

Just look at your estuaries, for example. The shrimp that we catch in the deep sea are bred in the marshes of Louisiana. From the marshes of Louisiana, through the rivers of the United States, from the land, DDT comes and hits the shrimp, affects their growth and kills them, and produces a potential poison to men.

You cannot split up the total environment. That is my point.

Thank you, sir.

Mr. HANNA. I think you are right. An over-simplification would be that the three environments are something like steam and water and ice, and the distinction is simply in the space between the atoms, and you don't find any different kind of chemical constituency in any one of these environments.

You are talking about nitrogen and oxygen and the various other elements, are you not?

Captain BAUER. That is correct, sir.

Mr. HANNA. And you are right as to the fact that what happens on the one may be through some particular phenomenon at the interface, but it does not stop. It is a continuing interaction, is it not?

Captain BAUER. That is correct, sir.

Mr. HANNA. I agree with you that it does not make any difference what we call it. I think that for the next 30 years, from 1970 to the year 2000 the single largest consideration for the Congress is going to be the quality of environment. I think every place you look, it is brought to our attention.

I think what you are saying is that there ought to be one place where there is general responsibility and continuing management. Is that not what you mean?

Captain BAUER. That is correct, sir. That is my entire approach.

Mr. HANNA. Then I think that my colleague from Michigan hit it when he talked about specific mission, because as I see NASA, NASA makes sense, because it is mission-oriented, and I don't see any reason why we could not have a mission-oriented agency in the sea, as long as there was back behind that an agency of general responsibility and continuous management that would take anything developed by the specific mission and give it general application, and would continue the management of it long after the mission had served its purpose.

Do you see any conflict in this concept?

Captain BAUER. No, I don't, sir, but that would require some reorganization of ESSA. For example, you would have to take out the land functions of the Coast and Geodetic Survey, which I believe it is true are the largest and most important of their operational responsibilities.

If you take out the land functions of the Weather Bureau, then you will have to split the Weather Bureau between the sea and the land.

Mr. HANNA. I am not suggesting that. I am not suggesting that, at all.

I am suggesting that there could be, insofar as the field of the ocean is concerned, or even as the environment as a whole is concerned, a mission-oriented agency that would be funded on the basis of specific mission, would call for the inclusion of a variety of talents drawn from those places in our society where we always draw for missions.

This has been happening ever since the Lewis and Clark days, and before then, that they would draw from the Government and from the academies and from business, and they would put the best of the talents of society to work to accomplish a mission, and then the results of that mission became, it seems to me, the workload of whoever had a general responsibility in the continuing management function.

I ask again, do you think that there would necessarily be a conflict, because I do not see any real conflict between the existence of NASA and the opportunities to utilize what is being developed in NASA in those agencies we now have that have a general responsibility in a continuing manner?

Captain BAUER. I thoroughly agree with you, sir.

Mr. HANNA. As I say, Mr. Chairman, I have been very struck with the gentleman's testimony, and I think that it will serve the committee very well to keep this as part of the work under our consideration as we move out.

I congratulate the gentleman for his excellent testimony.

Mr. LENNON. I thank the gentleman from California.

Captain, I recall so well your great service to those of us who have been involved on this full committee, and especially this subcommittee over the years. You were with us as a very outstanding consultant up until the time that the act was passed by Congress which authorized and directed the President to seek out and define and to appoint a Commission of 12 people, individuals, from the private sector with the capability, the technical background and skills and experience, and three from the Federal Government, to form the Commission on Marine Science. At the same time we attempted to establish a National Council, but met with frustration hither and yon, especially in the executive branch of the Government, before we even got into the passage of the final act that we are now talking about.

You will recall the fight we had in convincing the administration of what we thought was a plausible objective in creating this National Council.

The argument was, of course, that we had an interagency or ad hoc committee on oceanography, and you will recall our experience with that group, the gentlemen representing the various agencies of the Federal Government, who were involved in varying and sundry degrees with the marine sciences and oceanology, and oceanography. They did not represent, in our judgment, a level of policy making in the decision process from the various agencies.

We have been delighted, of course, with the contribution that the National Council has made, the way they have worked with the Commission.

Now, I did not select the members of this Commission. It was done. It took the President approximately 6½ months to select them.

Do you believe that this Commission that was appointed by the President had the background and the capability and expertise and knowledge to make a study in depth of those things that they were mandated to study, and to report back to the Congress and the President?

Captain BAUER. There is no question about the qualifications of the Commission, and their report is excellent, but if you will remember Dr. Stratton's testimony last week, he mentioned the fact that the total environment should have been considered perhaps, but he felt that it was beyond the scope of the power of the Commission to do anything but consider the marine environment.

Mr. LENNON. You recall his reason for making that statement. I do not recall him having said the lack of capability, but the recognition.

Captain BAUER. That is right. He felt it was beyond the organization.

Mr. LENNON. You will recall, too, that the Commission was mandated to make a determination as to whether or not, No. 1, there should be a Government structure, and No. 2, if they came to that conclusion, what type of Government structure.

This was, I thought, the most serious responsibility that the Commission was charged with. Now they have made that recommendation, and that recommendation, apparently, from the news media and from the various publications representing the very many segments of the private sector of the marine sciences, has been rather enthusiastically received.

I received a communication the day before yesterday from the Florida Marine Commission, and incidentally, I would like to suggest this to those of you on the subcommittee, and this is particularly addressed to the counsel, that he determine from the members of the subcommittee, as to whether or not their respective States have what may be described generally as a marine science council authorized by the legislature and subsequently appointed by the Governor and request them to make a study in depth of the report and to give us their recommendations in writing.

We would prefer them to testify, but if they cannot, we want it in writing.

I think that is an indication of the interest, especially from the coastal States, who have already gotten into this thing from the State level.

Mr. HANNA. If the gentleman will yield right there.

Mr. LENNON. I certainly will.

Mr. HANNA. I was in Sacramento last week, and as the gentleman well knows, Mr. Reinecke, who was a member of this committee is now the Lieutenant Governor, and under the law passed in our State, the Lieutenant Governor is the chairman.

Mr. LENNON. Of the California Marine Council, or the equivalent of the Commission?

Mr. HANNA. That is right, and he personally indicated to me that they were very anxious and eager to cooperate with us and hope that

we will give them just the information that you have indicated, and request their views.

Mr. LENNON. I appreciate that, and I would like that to be done by all the members of the subcommittee, to first, No. 1, determine if your State, whether a coastal or inland State, has a marine council at the State level, and if so, I would like for them to get involved in this with respect to this report, in making recommendations.

I have asked the Marine Council in my State, created 2 years ago, the executive director and the members, to meet and give us their views.

On page 6 of your statement, Captain Bauer, you give your reasons, or alternatives, to the recommendation of the Commission with regard to the recommendation of the establishment of NOAA. No. 1:

The Coast Guard should not be removed from the Department of Transportation.

There were many people who did not believe it should be removed from the Department of the Treasury. I remember we had a vote on the floor on that question. You go on to say that:

Serious consideration should be given to creating in the Coast Guard the responsibility of the operation and maintenance of all vessels owned and operated by the Federal Government.

You relate that to your proposal to abolish ESSA, because ESSA maintains and operates some 20 oceanographic vessels today, don't they?

Captain BAUER. I think of the large vessels and the small vessels included, that is probably correct, sir.

Mr. LENNON. If you abolished ESSA, and you take all of their vessels, of course if you abolish it, regardless of the size, and you say those above a certain size you turn over to the Coast Guard, what would you do with the others? Turn them over to the Department of the Interior?

Captain BAUER. No. Each agency in the Government of necessity must have small vessels. By that I mean shallow water craft type up to 50 or 60 feet. I am talking about the oceanographic vessels that go from 1,000 tons up, or 700 tons up.

Mr. LENNON. But that intrigues me, because you say the Coast Guard is a uniformed service, and you do know, as we all know, that the Coast Guard has a number of oceanographic vessels. Should they continue to be involved in oceanography?

Captain BAUER. Oh, yes, no reason why not. As a matter of fact, I think ultimately I would like to see the Coast Guard take over the Arctic operations.

Certainly they have a capability for the Antarctic that is great. They have all the icebreakers now, which was a result of the suggestion of this committee, as you remember.

They have done a remarkable job in the field of oceanography. As a matter of fact, the counsel and I drafted the bill putting them in the oceanographic business without restriction as they should be. They have been in the oceanographic business since the creation of the International Ice Patrol Treaty. As a matter of fact, the Coast Guard has many accomplishments in oceanograph.

For example, they were the first to use the conductivity bridge for the measurement of salinity. At that time, they were operating in space adjacent to the Woods Hole Oceanographic Laboratory.

They had to go into the oceanographic business, and did it, and did a fine job, to determine where icebergs were going to be from the point of view of the determination of the geostrophic currents of the Arctic.

There is no conflict that I see.

Mr. LENNON. What activities has the Department of the Interior engaged in in the field of the sea?

Captain BAUER. To determine what you need to know about the biota of the sea, you have to determine the parameters that permit the little beasties to live in the sea and grow. Without a knowledge of that, you are poorly looking at only one part of the entire problem.

The Bureau of Commercial Fisheries very early went into the oceanographic picture. They have done a terrific job.

Mr. LENNON. Captain, I don't want to be critical, but I recall just last year, perhaps a little later than it is now, but a little over a year ago, we were faced with this estuary bill, prepared legislation, and the Department of the Interior testified here before this committee, and they made it crystal clear that in their judgment the legislation was not needed, that they had the authority to move in this direction, but yet they have not moved.

Now, the gentleman who is chairman of the Subcommittee on Fish and Wildlife is holding hearings today, because the Department of the Interior, in spite of its representations before this committee that it had the authority under existing law, has not moved. He is now holding hearings on the general type of creating a commission to study this thing.

I have not been too enthused always with the aggressive attitude on the part of the Department of the Interior to involve itself in these matters.

Captain BAUER. Mr. Chairman, if I may make a remark to that, I think one of the biggest things that needs to be faced up to by the Congress is the realization of the effect of the Bureau of the Budget on what is testified to the various congressional committees by representatives of the agencies and departments.

As you well know, no one can make a statement before this committee, or any committee of the House or Senate without first having it approved and edited by the Bureau of the Budget.

Their editorial operations are not necessarily coincident with the needs of the scientific community or the technological community. Far from it. They have no capability in science.

So if the Department of the Interior personally feels that they should support a venture, and the Bureau of the Budget says, "No, you don't," they don't! That is why I am very glad to be able to talk here as a private citizen, because I can say these things, and I am sure that you know it.

I have seen our clerk running around in a panic, "Are all of the reports in from the various people concerned with the legislation?"

Well, all of the reports were sitting over on one desk, in the Bureau of the Budget, being paper massaged, edited, and so on, and until the Bureau of the Budget permits the agencies to testify as to their opinion, we are going to get nowhere by looking at departmental testimony.

One of the biggest difficulties that I had here on the staff, and I am sure counsel will agree, and I am sure you will agree, was to find out

what are the proper questions to bring the departmental beliefs on legislation. If you asked them a proper question, they will tell you, but they certainly will not make their true beliefs in their opening statement.

I wish that you could do something about that.

Mr. LENNON. You will recall, Captain, that in the hearings, and they were extensive and properly so, on the legislation that established the Commission and the Council, that there were a number of Members of Congress who openly advocated at that time—and that has been more than 2 years ago—the establishment of what people have described as a wet NASA, as the only basis on which we could move forward in the marine science field, and their argument was strong, and well put, that until such time as you had a Government structure of this type, that you would never be able to overcome their inability to get projects favorably and reasonably funded by the Bureau of the Budget.

You and I know that the Navy has, and I think properly so, over the years has claimed not only the lion's share, but most of the money that has been obtained in the field of marine science, on the philosophy of a national defense posture related to antisubmarine warfare.

I have come to this conclusion very, very slowly, because I was not one who favored bringing together the marine science spectrum from the agencies and departments where those marine science activities were related to the missions and roles of a particular agency or bureau. But I have come to the conclusion that the only way that you are going to move this program forward at a national level, with the participation of the Federal Government providing the leadership, and the universities and colleges and private sector, is to bring it together under an organization such as has been suggested by the Commission report.

Whether or not it should be an independent agency, or whether it should be all lumped together and put in one of the existing agencies of the Federal Government, I do not know.

There are a lot of people who believe that the only way we will ever again have a viable maritime program is an independent agency, and it has almost been proven to be true, as you know. We just don't have one.

I think it is most important that you came here this early in the hearings, and they will certainly last through this month. Speaking of the National Council, I have in my files a letter from Dr. Wenk to the effect, No. 1, that they have been instructed to make a study in depth of the Commission's report, and to make their recommendations to the Chief Executive.

I had a letter from him this morning saying that he expected to be able to present the position of the National Council, based on this study and its recommendations, to the Chief Executive by sometime approximately the middle of June, and the hearings will be, of course, continued to that time.

We want to do what is best. I think you know this to be a fact, and realize what we are trying to do. We are searching to find out what is best in the national interest.

If you are right, I hope we go that way. If you are wrong, I hope we go the other way. That is all I can tell you. We want you to know that we are grateful for your interest and your concern in this matter,

and the fact that you have spoken out in a manner of speaking against the establishment, if you want to put it that way, as you always did, and I admire you for it.

It gives us an opportunity to study much closer than we have had today your statement, and try to get some amplification of it, and then take these questions that you have raised back to those people who have already indicated their support of the Commission's report, and to those people we have every reason to believe will appear before the committee over the weeks to come in support of and against the recommendations of the Commission.

Now, outside of the Commission's recommendation of a Government structure, they made a number of other recommendations, as you know. You limited your statement today primarily to the so-called recommendation of the Commission for the Government structure.

We will stay here until we get a quorum call, if that is the will of the committee.

Would you like to add that to your statement, for the record?

Captain BAUER. I should like to say that the recommendations of the Commission are outstanding. By and large, they would supply, to my way of thinking, a great program for the development of the oceans.

Unfortunately, I do not agree with their recommendations when the subject matter is always given to NOAA. If you take NOAA out of their recommendations, and put it in an organization such as the Bureau of Commercial Fisheries, the Coastal Engineering Branch of the Army Engineers, the Geological Survey, and other active agencies, I think they are outstanding.

What I do object to is not the studies of their panels which are outstanding. I do object to the proposed organization. As you will remember from Dr. Stratton's testimony, the question of organization of how to accomplish these recommendations was considered by the Commission as a whole, not with the panel structure. If we could just leave NOAA out of their recommendations, and leave a blank until a Federal structure is arranged, the recommendations are fine. It is a marvelous job.

I object to purely the question of the organization.

I think they are to be congratulated for the best marine study in depth that has occurred in history. I am sorry that they did not consider, or feel that they should consider, the questions of the total environment, because Mr. Reedy went into the situation as follows, and I quote from page 57 of the transcript:

> Further down the road, of course, if you were to have a much larger reorganization of the Government, then it would become a totally different matter, but we felt that we had to operate within the context of the here and now, what exists as a governmental structure, what exists as a series of problems that must be tackled, and we felt that by bringing these agencies together we would have a maximum impact upon the problems that are affecting people today.

Further in the testimony of Dr. Stratton himself, he indicated that the Commission felt that they were limited to a study of only the marine environment.

My approach today is that the entire environment must be considered, and I don't mean outer space, even though that is important.

Let's talk about the environment of inner space. I should like to point out on this question that you have discussed so ably, the present

organization of a cooperative agreement between the Virginia Fisheries Research Laboratory, the Maryland Research Laboratory at Solomon's Island, and the Chesapeake Institute. They have agreed jointly to conduct a coordinated survey of the Chesapeake Bay. This has been going on now for some 4 years, and results are showing up.

There is everything to be said for State cooperation as well as national cooperation.

I just wanted to mention that, sir.

Mr. KARTH. Will the gentleman yield?

Mr. LENNON. Go ahead.

Mr. KARTH. Captain Bauer, to make my position perfectly clear, I think your suggestion that we study the total ecology, because there are relationships and interrelationships between everything, land, sea, air, and so on, is a great recommendation.

Don't misunderstand me. I think it is good, and I think we ought to study it, but really, the purpose for which the Commission was established was not to do that.

What we are interested in doing now is trying to get a mission-oriented program going in the field of marine science and oceanography.

A study of the kind that I think you and I are, at this moment talking about, will undoubtedly take years and years. It is not an easy subject matter, and I suppose there are many people who will disagree with whatever conclusions are drawn, for special interest purposes as well as for other reasons.

Nonetheless, as I see it, this Commission report and the objective of the Congress at this point, Mr. Chairman, is to have some kind of a mission-oriented research program going on to develop the oceans to a point where it can become much more useful to mankind than it presently is. These are mission-oriented programs that we are talking about.

I think only by doing what has been recommended, can we get some mission-oriented programs started to do the basic and applied research that is necessary in the whole field of trying to make the oceans more productive and meet man's needs here on earth.

I don't disagree with the witness at all, Mr. Chairman, but I think that is a completely different and separate proposition that he raises. Certainly it ought to be done, and how we go about establishing a situation so that it can be done, that is another matter, that I think requires other legislation.

Mr. LENNON. Counsel has a question to ask an old friend.

Mr. DREWRY. It is more an observation, Captain Bauer, than a question.

No matter how we work on this, we are groping with the problem of the high echelon management, which is concerned with the total environment. In the United States, there is only one man, and that is the President.

Captain BAUER. That is correct.

Mr. DREWRY. As we have discussed many times before, the only solution to the management of the total environment would be to have a one-department Government, and one committee of Congress, and one President. And, of course, that it out of the question, as a practical matter.

I say that is more of an observation. I, too, want to echo my bosses, that I think that your statement has been great, and I think it is making a real contribution to what we are trying to do.

We did in our charter to the Commission tell them to come up with a recommendation of an organization. We did not tell them we were going to accept that organization.

They have carried out their responsibilities, and we are now in the early stages of trying to determine what is the best way to take care of it.

Now, Congressman Anderson in his references, and of course it is in the Commission report, commented on the fact that there was not a wholesale consolidation of all marine activities.

By the same token, I think what they were saying there is that for the purpose of getting along in the marine areas, that the effective thing would be to pull the major things together, and let time and future study develop other things, just as this meeting that Congressman Dingell is holding to establish an environmental council, and his bill, which proposed to cover everything on earth and the atmosphere and space.

So as I say, I have found your observations to be very stimulating, and I am sure they will be very useful.

Captain BAUER. Thank you.

Mr. LENNON. Thank you, Mr. Counsel.

Are there any other questions of the gentleman?

Mr. SCHADEBERG. No, thank you, sir.

Mr. LENNON. We thank you again, and we know that you are in the area. We hope to have you back. We may get you engaged in a dialog with these other witnesses. I think that might be a good way to get the thing on the record.

Let me announce that the hearings will be continued. The committee will sit tommorrow morning at 10 o'clock. We will have with us Congressman Rogers C. B. Morton, a longtime member of our committee on Merchant Marine, who has always demonstrated a great interest in the subject matter; Dr. Chalmer Kirkbride, who is vice president of the National Security Industrial Association, and Adm. E. C. Stevens, U.S. Navy (retired) former oceanographer of the Navy.

I guess you were here the other day and understood that the 12 members of the Commission indicated their strong support of the report in its entirety, that is, the 12 civilian members indicated their strong support of the Commission report, and especially the insistence that we move as rapidly as we possibly could in the implementation of their recommendation on the Government structure or agency.

That thought was shared and expressed here by a former Government member of the Commission who is now not a part of the new administration, and that was the former Under Secretary of the Navy, Mr. Baird.

With that, the committee stands in recess until tomorrow morning at 10 o'clock.

(The appendixes with Professor Bauer's statement follow:)

Appendix 1

Department of the Interior—Geological Survey-Marine Geology Program

Geologic information is fundamental to appraisal of resource potential, to effective management of an as yet incompletely specified public domain, to engineering development of coastal zone, and to policy decisions for international agreements regarding limits of sovereignty and use of oceanic resources beyond national limits. The rapidly increasing use of the seabed and its resources, and increasing concern with the effects of extraction of resources on other uses, requires a broad understanding of the geologic framework of the Nation's continental margins and the deep ocean beyond. This understanding is growing very slowly and needs to be substantially accelerated.

The proposed Marine Geology Program is planned to accomplish in 5 years a regional understanding of the Nation's continental margins and their transition into the deep ocean floor, and in 20 years the systematic geologic analysis and mapping of all the continental margin of the United States at a scale of 1:250,000, adequate for general and regional resource assessment, and for preliminarly planning related to foundation problems, geologic hazards, and land use.

To achieve a regional understanding of the continental margins during the first 6 years of the program, the Geological Survey will:

(1) Investigate and map 10 areas at the scale of 1:250,000, using the Coast and Geodetic Survey bathymetric maps as bases. The areas are selected where resource targets are known or where investigation will give information needed to understand regional geologic patterns.

(2) Make regional reconnaissance traverses and investigations across the continental margin-ocean transition zone where required for the regional synthesis (scale 1:1,000,000 or smaller).

(3) Study in more detail (scale 1:62,500 or greater) those areas or geologic processes for which information is critically needed for the broader compilations and interpretations.

Results to be expected by the end of 5 years will include:

A regional synthesis, at a scale of 1:1,000,000 or smaller, of the geology of the U.S. Continental Margin and ocean interface.

Geologic maps and analyses of the 10 high priority areas at a scale of 1:250,000.

Numerous reports on economic and scientific aspects of the program will be published each year. Preliminary maps of most of the areas and some of the regional syntheses will be available in three to five years; most final maps and analyses will be published within two years after completion of the 5-year phase.

The results of the first 5-years will determine priorities for selecting areas and investigations for the remainder of the 20-year program. Investigations requiring ship time are carried out in several ways:

(1) Through cooperative programs with other Federal agencies, especially Navy Oceanographic Office, ESSA, Coast Guard, and Bureau of Commercial Fisheries. For the 5- and 20-year program, about half the required ship time will be Federal ship time utilized through such cooperative programs. The proposed funding does not include money for Federal ship time.

(2) Through research contracts with universities. Geological Survey scientists work jointly with university scientists and graduate students on these programs. About one-quarter of the funds for the 5- and 20-year program will be in university contracts, and these will provide about one quarter of the total ship time.

(3) The remaining one-quarter of the ship time for the program will be acquired by charter of industry ships. Much geophysical data, most coredrilling, and use of research submersibles will also be by contract with industry.

Appendix 2

Brief Description of U.S. Geological Survey Projects in Marine Geology

Atlantic continental margin

A broad reconnaissance of the Atlantic shelf recently completed by the Geological Survey has identified several areas that require intermediate scale mapping for assessment of their resource potential, and has delineated areas where

topical investigations will contribute significantly to knowledge of the geologic history of the shelf. The investigations on these target areas include:

Current

Intermediate scale geologic mapping off southern New England, in the Gulf of Maine (petroleum, and sand and gravel) and off the Carolinas (phosphate, petroleum, sand). Sedimenation and provenance studies in selected estuaries and coastal zone.

Planned

Detailed geophysical studies on Georges Bank, an area of high petroleum potential.

Test drilling on the Blake Plateau to determine the three-dimensional distribution and geochemistry (grade) of manganese and phosphate nodules.

Research drilling to compare rock sequences in the northern and central part of the shelf with those penetrated in JOIDES holes off Florida.

Reconnaissance geophysical surveys and sampling to determine thickness, nature, and oil and gas potential of continental rise sediments and the geologic boundary between the continental margin and the deep ocean basin.

GULF OF MEXICO-CARIBBEAN AREA

Regional geologic analyses of the Gulf will be synthesized to provide information required to manage the resources of this region, potentially one of the world's richest storehouse of oil, gas, and sulfur. Both detailed and reconnaissance studies will be continued in the Caribbean area. Included are:

Current

Analysis of seafloor sediments to determine distribution of heavy metals deposits and relation of seafloor sediments to living resources.

Geochemical investigation of organic materials in estuarine sediments to find the effect of these materials on mineral concentration and to study the interplay between sediments and industrial pollutants.

Detailed geologic mapping in selected coastal areas, such as Padre Island National Seashore, to understand the dynamics of sediment movement, and in particular the destructive changes wrought by hurricanes.

Planned

A regional geologic and structural map of the entire Gulf of Mexico to be prepared at reconnaissance scale from data acquired on cooperative programs with the Navy Oceanographic Office.

Acceleration of the existing cooperative geologic mapping program with the Commonwealth of Puerto Rico to decipher the structural framework and evaluate the petroleum and mineral potential of the Puerto Rico Shelf.

Extension of regional geologic and geophysical studies of the Gulf into the Caribbean Sea through a cooperative program with Navy Oceanographic Office. This program will be a U. S. contribution to the International Caribbean Year, and the International Decade of Ocean Exploration.

PACIFIC CONTINENTAL MARGIN

Major oil fields are contained in the nearshore shelf off California and marine heavy metal placers occur off the coast of northern California and southern Oregon. The seaward extent of these petroleum and placer deposits cannot now be evaluated due to lack of regional geologic analyses. Both reconnaissance and detailed investigations are required in this region to assess the geologic hazards in this earthquake-prone belt. Pacific continental margin studies include:

Current

Compilation of land-sea geologic transects at an intermediate scale for the inner shelf off northern California and southern Oregon to delineate heavy metal placers and areas of high petroleum potential. Relation of these data to onland mineral deposits and geology in order to enhance the overall resource appraisal.

Large-scale geologic mapping, coupled with direct seafloor studies and core drilling, in areas of high potential for thick placer and lode deposits of heavy metals off the southern Oregon coast.

Geologic mapping on the central California shelf at an intermediate scale to locate potential earthquake-generating faults and to determine their history of

movement, and to outline areas of unstable seafloor sediments that are subject to mass movements (submarine landslides) due to earthquake shock. Delineation of broad target areas that contain favorable structures for production of oil and gas.

Geologic investigations in areas of rapid urban expansion in coastal southern California and the San Francisco Bay region. Extension of large-scale (1:24,000) mapping marginal to San Francisco Bay to cover the entire Bay, and acceleration to provide geologic parameters ahead of both private and Federal engineering construction to insure intelligent planning and wise land use.

Planned

Initiation of detailed geologic mapping of the southern California shelf to assess the geologic hazards of this area which contains hundreds of offshore producing oil wells, defense installations, and proposed coastal or offshore nuclear power plants.

Reconnaissance geologic mapping and geophysical studies on the outer continental shelf and slope off southern California to determine the seaward extent of basins that produce petroleum in nearshore areas.

Topical mineral resource evaluation to assess the phosphate deposits that occur on many of the ridges on the southern California shelf with core drillings and geochemical studies to determine their grade, extent, and potential economic value.

Topical investigations on the nature of the interface between the continental block and deep ocean floor, and relationship of the ocean fracture zones (Murray and Mandocino) to the continental margin.

ALASKA CONTINENTAL MARGIN

This large shelf area (more than 500,000 square miles) contains known placer deposits of gold, tin, and platinum, and also has an impressive known and potential petroleum reserve. The Geological Survey has led in the collection of onland and marine geologic data in this area, and remains in the forefront of these investigations. The projects include:

Current

Investigation of offshore placer deposits to establish their distributional and depositional patterns, to examine their internal structure to facilitate extraction techniques, and to evaluate their economic potenial. Sudies are underway in three areas: 1) Off Nome, where raised beaches have yielded more than 5 million ounces of gold, five submerged gold-bearing beaches have been found and are being studied in detail; 2) the floor of the Bering Sea, where previous Geological Survey studies have outlined now submerged beach ridges and river channels that may have localized gold concentrations; and 3) in the Gulf of Alaska and southeastern Alaska, where submerged beaches and drainageways lie offshore from known gold deposits.

Intermediate scale mapping of the nearshore shelf of the central Gulf of Alaska to guide management and assessment of this area for which public leasing has been scheduled. Mapping to the outer edge of this shelf and adjacent slope to provide information on petroleum potential.

Planned

Reconnaissance traverses, some to be done from submersibles beneath the Arctic ice pack, to investigate and broadly assess the petroleum-bearing basin off northern Alaska.

Three large sedimentary basins recently discovered by the Geological Survey on the Bering Shelf will receive more detailed studies to outline their size and internal structure.

Study of Aleutian Arc-Trench System and adjacent Pacific Ocean floor to understand their history and the mechanism by which earthquakes such as the disastrous 1964 earthquake are generated.

Continuation of cooperative investigations with ESSA and the Navy Oceanographic Office on the Bering Shelf, and implementation of a formal U.S.-Soviet cooperative marine geology research program on the Bering Shelf. Arctic studies with the Coast Guard are planned.

DEEP OCEANS AND OCEANIC ISLANDS

Cooperative deep ocean studies will continue with other organizations (Department of Defense, ESSA, and the Coast Guard), and will contribute to the knowledge of submarine volcanism, organic content of deep sea sediments, and recent sea level changes. Participation is current or planned for such projects as the Deep Sea Drilling Project (JOIDES) and the International Decade of Ocean Exploration. Studies will be accelerated in the Territorial Islands, Gulf of Mexico, and Caribbean Sea to insure a firm geologic base for assessing the deep ocean resource potential and for analyzing the structural evolution of these areas. These cooperative programs call for the following studies:

Current

Scientific and economic importance of cores taken in the Deep Sea Drilling Project (JOIDES) in cooperation with NSF. The Atlantic Ocean drilling has been completed; the Pacific Ocean drilling is underway.

Planned

Multi-disciplinary study of deep ocean structures, the relationship between the oceanic and continental crusts, the geochemical properties of deep ocean sediments, and rates of sediment accumulation will be undertaken as ships of opportunity become available or if work is funded under the International Decade of Ocean Exploration.

Appendix 3

Current Research Contracts

Woods Hole Oceanographic Institution: Atlantic Shelf.
Duke University: Atlantic Shelf.
Louisiana State University: Gulf of Mexico.
Texas A & M University: Gulf of Mexico.
University of California, San Diego: Pacific Shelf.
University of Southern California: Pacific Shelf.
Stanford University: Laboratory Studies.
Oregon State University: Pacific Shelf.
University of Washington: Bering Sea, Gulf of Alaska.
University of Alaska: Bering Sea, Gulf of Alaska.

COOPERATIVE MARINE PROGRAMS, RECENTLY ACTIVE AND PLANNED

Naval Oceanographic Office: Gulf of Mexico (January-August 1969), Caribbean Sea (November 1968, 1970—proposed), Pacific Coast (proposed).

Coast Guard: Mid-Pacific (July 1968, August 1970—proposed), Arctic Ocean (September 1969—proposed), Gulf of Maine (proposed).

ESSA: Bering Sea (June 1968, summer 1969).

NSF: Deep Sea Drilling Project (1968, 1969).

NASA: Gulf of Mexico-Caribbean (1969).

Commonwealth of Puerto Rico: Puerto Rico Shelf (March 1968, January 1969, January 1970).

California Division of Water Resources: Monterey Bay (September 1969—proposed).

Appendix 4

U.S. Outer Continental Shelf (O.C.S.) Production Values

Value and quantity of O.C.S. production:

(1) *Sub-seafloor fuels and minerals:* Total value of oil, gas, and sulfur from O.C.S. in 1968 was $1.2 billion.

(2) In 1968, alone, more than 250 million barrels of oil and 1.4 trillion cubic feet of gas were recovered from submerged Federal lands.

(3) In terms of cumulative values, the value of oil, gas, and sulfur production from O.C.S. has exceeded $5.7 billion since 1953.

(4) *Seafloor hard minerals:* Total value of sand, gravel, shells, feldspar, limestone, zircon, dredged from U.S. offshore areas in 1968 probably exceeded $60 million, but bulk came from State lands.

(5) *From seawater:* Salt, bromine, and magnesium metal and compounds. Total value about $150 million in 1967.

Relation to other U.S. production and long-term trends:

(1) Expressed as a percentage of total domestic petroleum production, the O.C.S. provided 8.1 percent in 1968, compared to 6.8 percent in 1967; by 1980 the figure is expected to reach 30 percent and some estimates place it as high as 60 percent.

(2) In dollar values, annual production of oil, gas, and sulfur from O.C.S. has increased from $423 million in 1960 to $1.2 billion in 1968; by 1975 the annual figure is expected to reach nearly $3.5 billion.

Income to the U.S. Treasury from offshore minerals:

(1) Over the past 16 years, total income to the U.S. Treasury from leasing of offshore mineral rights, and royalties from all mineral production has exceeded $4.4 billion, of which $3.3 billion was from bonus sales.

(2) During the single year preceding June 1968, such leasing brought more than $1.7 billion into the Treasury; the revenue from lease sales in 1968 was $1.3 billion.

(3) By comparison, lease sales and royalties from mineral resources on land have yielded only $1.6 billion for the 46-year period prior to 1967.

(4) Royalties for offshore oil, gas, and sulfur reached an annual rate of $201 million in 1968, or a monthly average of about $18 million; currently the revenue is averaging $21 million per month.

Areal coverage of production and leasing on Outer Continental Shelf:

(1) The total-area of the O.C.S. presently under lease is 4.4 million acres, of which 2.1 million acres are in producing leases.

(2) Producing leases constitute about 4/10 of 1 percent of the total Continental Margin.

(3) Per capita consumption of all types of energy by 1980 is estimated to become double that of 1950. Of this, petroleum products (including gas) will supply about 75% of the future needs.

(4) In general there has been a slow rate of development of hard mineral resources *on* the shelves (a growth of less than 20% in value in 7 years), while the development of oil, gas and sulfur resources *beneath* the shelves has been very rapid, more than tripling in the same period.

Capital investment in offshore petroleum:

(1) The petroleum industry invested about $2.5 billion in offshore operations in 1968, compared to about $1.5 billion in 1967.

(2) Cumulative investment over the years has been approximately $9.5 billion.

Appendix 5

The Assistant Secretary of the Navy,
(Research and Development)
Washington, D.C., October 30, 1967.

Dr. Stanley A. Cain,
Assistant Secretary of Interior for Fish and Wildlife and Parks, Department of Interior, Washington, D.C.

Dear Dr. Cain: The enclosed Memorandum of Agreement is to formalize joint efforts that have been conducted on an exploratory basis by the Bureau of Commercial Fisheries and the Naval Oceanographic Office. I am happy to be able to participate in this effort to improve the economic potential of the fishing industry.

Please return the signed original to the Oceanographer of the Navy for photographic reproduction and distribution.

Sincerely,

Robert A. Frosch.

Memorandum of Agreement Between the Department of the Navy and the Department of the Interior

The Department of the Navy and the Department of the Interior have many common interests in directing research efforts toward understanding and describing the oceans. The Navy and Interior have similar needs to develop techniques for forecasting ocean environmental features for fleet operations and for fish forecasting and detection.

The Navy, in discharging its responsibilities for our national defense efforts involving the ocean environment, will continue to require a better understanding

of those environmental characteristics affecting its operations. In particular, a number of operational problems faced by the Navy are biological in origin; this fact strengthens the mutual interests of the Navy and Interior and further enhances the value of a cooperative program.

In the interest of development of commercial and sport fisheries by Interior, research is directed primarily toward the acquisition of knowledge about fishery resources. Commensurate with these interests is the requirement that fishery scientists understand the ocean environment and the relationships that exist between environmental fluctuations and the distribution and abundance of living resources.

It is agreed, therefore, that the Department of the Navy and the Department of the Interior will join in a cooperative effort to study those aspects of the ocean that are of mutual concern.

Examination of active programs and interest suggests that the following areas merit formal immediate cooperative development: Acoustic characteristics and detection of marine organisms, environmental monitoring and prediction, and satellite applications in ocean research (see Appendix). Additional areas for possible future cooperation include, but are not limited to, an intensive water column study, atlas preparation, radio ecology and deep submergence applications.

ROBERT A. FROSCH,
Assistant Secretary of the Navy for Research and Development.

OCTOBER 30, 1967.

STANLEY A. CAIN,
Assistant Secretary of Interior for Fish and Wildlife and Parks.

OCTOBER 31, 1967.

O. D. WATERS,
Oceanographer of the Navy.

OCTOBER 31, 1967.

ACOUSTIC CHARACTERISTICS AND DETECTION OF MARINE ORGANISMS

INTRODUCTION

The U.S. Navy and the Bureau of Commercial Fisheries are being hampered in the prosecution of their missions by a lack of knowledge concerning the following bioacoustic problems: Target identification, interference from biological causes, system performance and requirements, and knowledge of the temporal and spatial distribution of biological sonar targets. Parallel approaches to these problems are being made by both Navy and Fisheries personnel.

By combining the Bureau of Commercial Fisheries' ability to capture and identify fish and the ability of both the Navy and the Bureau of Commercial Fisheries to detect them on sonar, a basis is provided for a better understanding of the acoustic characteristics and detection of marine organisms.

OBJECTIVE

To define the acoustic characteristics of marine organisms and to develop detection and classification techniques for biological sonar targets.

APPROACH

The U.S. Naval Oceanographic Office and the Bureau of Commercial Fisheries will conduct studies to determine the acoustic characteristics (i.e., target strength and attenuation) of individual and schooled fishes. The Bureau of Commercial Fisheries will locate, capture, and identify fishes suitable for these studies. Subject to higher priority commitments, the Navy will provide sonar-equipped vessels and, similarly, the Bureau of Commercial Fisheries will make available its sonar-equipped vessels for joint cruises whenever possible. The U.S. Naval Oceanographic Office, in conjunction with the Bureau of Commercial Fisheries, will examine the suitability of available sonar systems for detecting, classifying, and determining the abundance of marine organisms.

ENVIRONMENTAL MONITORING AND PREDICTION

INTRODUCTION

The routine collection of environmental data is necessary for a variety of operational and research programs. These data are collected from a number of different platforms, such as military, fishing and research vessels, buoys, and

aircraft. A coordinated effort in collection and analysis of these data will enhance the military value of the Antisubmarine Warfare Environmental Prediction Service (ASWEPS) and provide a signicant input to fish forecasting.

OBJECTIVE

To determine techniques for predicting the distribution and frequency of occurrence of biological false sonar contacts and abundance and availability of fish resources, and to develop methods of applying such prediction models, in conjunction with the cooperative prediction systems, such as those of ASWEPS, Fleet Numerical Weather Facility (FNWF), and some Bureau of Commercial Fisheries laboratories.

APPROACH

The U.S. Naval Oceanographic Office and the Bureau of Commercial Fisheries will exchange scientists to coordinate and implement an environmental monitoring and prediction program utilizing Navy and Bureau of Commercial Fisheries tactical environmental data and prediction techniques.

The U.S. Naval Oceanographic Office (NAVOCEANO) and the Fleet Numerical Weather Facility (FNWF) will provide synoptic environmental charts for use by the Bureau of Commercial Fisheries in delineating areas favorable for exploiting fish resources.

The U.S. Naval Oceanographic Office and the Bureau of Commercial Fisheries will conduct experiments to establish the degree of coorelation between thermal structure and fish distribution, and to develop, test, and evaluate prediction models. Experiments of the type proposed in Project Porpoise are particularly encouraged; its objectives are to determine the interactions between ocean and atmosphere, the effect of these processes on the ocean climate, and ultimately the effect on abundance and distribution of living marine resources.

Satellite Applications in Ocean Research

INTRODUCTION

Satellites provide a unique tool for global surveillance on a regular basis. Studies in progress indicate that it may be possible to determine such features as surface thermal structure, current boundaries, sea state, and biological phenomena such as presence of fish oils, fish schools, bioluminescence, and plankton blooms. A broad geophysical knowledge of the real-time distribution of such features would be of great importance to fishery applications. Also, satellites will be important as relay stations for data telemetered from surface platforms and as aids to navigation.

OBJECTIVE

To determine the feasibility of obtaining useful oceanographic data from remote sensors in aircraft and spacecraft and to determine the cost-effectiveness of obtaining data in this manner in comparison with alternate methods.

APPROACH

The Departments of the Navy and Interior will cooperate in programs to determine the feasibility of obtaining meaningful oceanographic data from space and the application of these data to prediction systems for biological and physical phenomena. Cooperation will be carried out primarily through the NASA/Navy Spacecraft Oceanography Project, with additional projects under the ASWEPS Program.

Effort will be mainly of two types: (1) development of techniques and remote sensor equipment for use in aircraft, which later may be used in satellites for direct detection of fish schools and the measurement of oceanographic features affecting abundance and distribution of such schools, and (2) interpretation of environmental data now being collected by satellites, to determine their accuracy and relevance to prediction of biological and physical phenomena.

(Whereupon, at 12:25 p.m., the subcommittee adjourned, to reconvene at 10 a.m., Thursday, May 8, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

THURSDAY, MAY 8, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:25 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. The committee will come to order.

This morning we have the happy privilege of hearing three very distinguished Americans, a former colleague, a very capable and dedicated member of this committee for a number of years, whose move to another committee we can all appreciate, the Hon. Rogers C. B. Morton, a Member of Congress; also, Dr. Chalmer Kirkbride, vice president of the National Security Industrial Association; and Rear Adm. E. C. Stephan, the former Oceanographer of the Navy.

Our first witness this morning will be our colleague and friend, Congressman Morton.

I assume that copies of the Congressman's statement have been distributed.

Let me go off the record.

(Discussion off the record.)

Mr. LENNON. Mr. Morton, we will be delighted to hear from you for many reasons, sir, particularly your great interest in the subject matter that we are discussing now.

STATEMENT OF HON. ROGERS C. B. MORTON, A U.S. REPRESENTATIVE FROM THE STATE OF MARYLAND

Mr. MORTON. Thank you very much, Mr. Chairman.

First, may I express a personal note, that it is a real pleasure to be back in the room with my friends and colleagues who work on the Merchant Marine and Fisheries Committee and on the subcommittees of it. I feel a bit humbled by the size of the subject you are considering. I would like to congratulate the committee for attacking the problem in the way you are attacking it and, that is, developing background positions before attempting to draft or consider specific legislation.

I have a short prepared statement which I would like to read.

Mr. Chairman and members of this subcommittee, I appreciate the opportunity to testify in support of the fine report submitted to Congress and the President on January 11 by Dr. Stratton and his fellow commissioners.

I think the chairman and members of this subcommittee are due a word of commendation also for moving quickly to extend the life of the Marine Sciences Council and then to conduct these background hearings on the Stratton Commission report.

In a report of the scope of the one under discussion here, there clearly are going to be suggestions, recommendations and observations that all of us will not agree with. I am certain the reorganization proposal will bring about anguished cries from within the Federal Establishment.

So, while it may be appropriate for others to accent their differences with the Commission findings, in these remarks I would like to stress my support for the basic findings of this distinguished Commission.

Gentlemen, we must have a strong national program in which the private sector can flourish, the academic community provide scientific leadership, and the Governments—Federal and State—provide appropriate support and coherent direction.

We in the Congress have a real responsibility to seize the challenge laid down by the Commission report to get on with the job. We have had an entire decade of reports, studies and recommendations. Now is the time for action.

I strongly support the conclusion of the Commission that we must begin a major move into the sea—for our security, for the quality of shores and bays, for increased harvest of the seas' resources, for improved knowledge of our weather—and to do this, we first have to set the Federal house in order.

I subscribe to the basic recommendations of the Commission that an independent agency be established to meet this critical need, and I have introduced a bill—H.R. 4838—to achieve this end. I feel a mere regrouping into an existing department, or continuation of the present council arrangement—no matter how effective the leadership—will simply be inadequate.

I hope you gentlemen of this subcommittee will proceed with legislation carrying out this recommendation as soon as these hearings are concluded.

I hope the President will lend his full support to this proposition. As the President himself stated in a speech in Miami last October 30:

> If we do not take steps soon to upgrade and organize our national oceanographic effort, we will not only delay the economic benefits the sea can bring us—we may also find ourselves in second place in underwater security.

As the workings of this subcommittee have testified, this is not a partisan question. If we succeed now in taking action, it will only be because gentlemen such as the distinguished chairman from North Carolina and the distinguished members from Florida, Virginia, and other States, have helped lead the way.

I hope you will report out a National Oceanic and Atmospheric Agency bill—and I will join you in working for its passage during this session.

Dr. Julius Stratton stated before you April 30 an expression I would like to endorse:

> A failure to take bold and major actions—will, in my own judgment, be disastrous to the best interests of our country and condem us to another decade of studies and debate.

Mr. Chairman, I realize this is a very general statement. It does not address itself to the specifics of the problem or to the many details that were brought out in "Our Nation and the Sea," the report of the Commission. My principal purpose here is to urge you to continue with what you have started here and follow it all the way through to the point of submitting to the Congress appropriate legislation.

I would like to add that I do not have too much pride of authorship in the drafting of H.R. 4838, which does address itself to part of the Commission report; I submitted the bill as a first step. It would be easy for us to set back and give lip service to the proposition of reorganizing the entire Federal Government so that we have in it a department of the environment. This could be done in the Department of the Interior by taking out certain of its functions such as the territorial and insular affairs function, perhaps the Indian functions, and others, and restructuring it so it would be a department of environmental management; but I think we all know the practical side of this. I think we all are familiar with the structures of the Congress well enough to know that preceding the attainment of such a final goal we have to take intermediate steps. I think a bill which this committee can come out with that would establish a national oceanography agency will be a good intermediate step and I hope the committee realizes in its wisdom that in this area we are going to have to crawl before we can walk.

Mr. Chairman, I would also like to call attention to remarks that were made in the record by the witness a few days ago, pointing out the difficulties we are having in managing the environment of the Chesapeake Bay. This is a more sharply focused document dealing with the problems of a specific estuary, but it points out the fact that as of today we do not have the kind of management we need to save areas of the environment from total pollution and total consumption through the works of man.

I distributed the remarks that I made in the record. I do not ask that they be part of the record of this hearing, but I call them to the attention of the subcommittee members and would solicit their patience to look through them and would be pleased to have any comments, criticisms, or remarks they might have dealing with this subject.

I certainly appreciate the opportunity of being here, Mr. Chairman.

Mr. LENNON. Thank you, Congressman Morton. I commend you for the service dedicated to your district and to your State and the Nation as a member of this full committee and a former member of this subcommittee. You have always been a person who has been fair and impartial and who, when you reached a decision in your own mind, took it and you stayed with it, and I commend you for it.

Counsel has suggested to me that he thought it would be appropriate to have printed in the record immediately following your prepared statement the statement that you made on the floor, which we have copies of here and, since it is so inexorably related to the problem in its entirety that we are covering now, without objection, I would ask unanimous consent that it would be printed in the record of the hearing at this point.

(The statement referred to follows:)

[From the Congressional Record, Tuesday, April 15, 1969]

APATHY IN CHESAPEAKE BAY DEVELOPMENT

(By Representative Rogers C. B. Morton (R.-Md.))

Mr. Speaker, before us today is another bill, which I support, aimed at controlling pollution of our water resources. The measure authorizes new weapons—in the form of funds, demonstration projects, and educational programs—to be used in our fight against this encroachment on our environment.

We can see the vital need for acts of this nature when we consider the impact of pollution on a specific body of water. For this reason, Mr. Speaker, I would like to speak at this time on a matter of grave economic and environmental importance to this Nation. This is the rapidly accelerating deterioration of Chesapeake Bay, the largest, possibly the most magnificent, and certainly the most productive estuarine area in the United States.

Mr. Speaker, let me hasten to say I am indebted to many people who are dedicated to the proposition of conserving our environment, and particularly to saving this magnificent Bay and its system of watersheds.

We have been guilty of an almost criminal neglect in allowing urban and technological pressures to stalk virtually unchecked through the estuarine environment. Pollution is steadily, silently winning its fight against society. Its arsenal consists of ignorance, temporizing and apathy—simple weapons which man effectively uses against himself.

If the Chesapeake Bay water resource planning and concomitant action are to be more than a frantic race to catch up with the present, immediate action must be forthcoming. A study of wide scope is urgently needed to develop a comprehensive plan to set forth an effective and rational program of management for the Chesapeake Bay. The Corps of Engineers has been authorized to make this study; the problem has been that the funds have not been appropriated.

The Chesapeake Bay, situated as it is in a rapidly expanding industrial and urban complex, is as vulnerable to the adverse effects of the works of man as any other estuarine system in the world. In order to save it, we must institute a sound program based on a firm foundation of an expanding estuarine and watershed management technology.

The problems that are emerging today forecast the magnitude and complexity of problems expected in the future. In 1960, the 64,000 square mile drainage basin was the recipient of the waste products of an estimated 11 million people.

This population will grow to approximately 17 million by 1990 and is projected at 30 million in the year 2020.

The increasing nutrient and chemical loads in the Bay system is a problem of great concern. One appalling source of this is the District of Columbia sewerage system. After final treatment, it discharged some 8 million pounds of phosphorus and 25 million pounds of nitrates into the Potomac River annually. Unless tertiary treatment facilities are provided, the above numbers can be expected to double within the next 25 years. An excess of chemical nutrients frequently leads to explosive blooms of algae and to increased growth of noxious aquatic weeds which triggers other problems. These noxious weeds tend to trap silt, potentially causing a shoaling problem. Small boats are inoperable in areas heavily infested by weeds. Further, weeds affect the recreational and esthetic use of the waterways. If nutrient discharges are excluded from a flowing nontidal river, the river in time will revert to its natural state. But, the damage done to the estuary by excess nutrients is virtually irreversible because of the continuous recycling of the nutrients.

It is generally believed that the present trend toward more intensive urban development in the United States, and in nearly all other nations, will persist at least through the end of this century. Problems associated with water resources management in urban areas have become both acute and complex. As this development moves along the tributaries of the Bay system, we shall see radical changes as more and more agricultural and forest lands are replaced by streets and roofs.

Urban construction skins the earth's surface and can increase sediment yield a thousandfold. These sediments enter the Bay and smother bottom-dwelling organisms and create esthetically objectional conditions. Over the centuries, shore and bank erosion have removed much fine agricultural land, in fact a number of islands in the Bay have completely disappeared.

Urban development tends to increase runoff, which, in turn, lowers the groundwater table. Depending on the extent of development, this can cause a measurable decrease in base flows during drought periods, which can have a significant effect on salinity values in the tributaries.

Growth in impervious areas increases both the magnitude and frequency of flooding, which can have a decided effect on water quality in the estuarine environment.

Rapidly expanding electrical power requirements and the resulting demand for larger powerplants are requiring use of large volumes of estuarine water for cooling purposes. One proposed plant on Chesapeake Bay will use about 1 million gallons of water per minute for cooling, with a rise of 10 to 12 degrees Fahrenheit in water temperatures. The exact effects of heat on many estuarine species is not well known, but this problem is being studied by a number of scientific and educational institutions.

The States of Maryland and Virginia have no technically reliable system to evaluate the effect of thermal loads on specific Bay areas. On the other hand, some public utility companies have spent considerable sums on the construction of hydraulic models in an effort to estimate the effects of thermal electric plants on aquatic environments.

The protection of aquatic life from adverse water quality factors is much more complicated in the estuary because of its diversity of life and the fragile nature of its ecological interrelationships. The subtly shifting estuarine equilibrium can easily move toward ecological disaster through neglect or mismanagement. A grave example of our lack of understanding of ecological balance occurred in Virginia in 1966, when the oyster crop was virtually destroyed by *Michinia nelsoni*—MSX. A better knowledge of the basin system might have minimized the spread of this oyster-killing fungus.

Accelerated urban development, an increasing amount of leisure time, and a generally expanding level of personal income have created a great demand for water-based recreation in the Bay area. Conversely, and ironically, the industrial and economic base of the prosperity that generated the demand also threatens to destroy the existing recreation potential by its deleterious effect on the water quality upon which water-based recreation depends.

There are other significant threats to the Chesapeake Bay environment. These include both inter- and intra-basin diversions of fresh water inflows. Current examples are first, the deepening of the Cheseapeake and Delaware Canal, which will increase the net amount of water flowing from the head of Chesapeake Bay into Delaware Bay from about 900 cubic feet per second to about 3,000 cubic feet per second; and second, the Baltimore water supply tunnel, which taps the Susquehanna Rivera above Conowingo Dam. Fresh water diversions can alter the salinity regime of the headwaters of the Bay, affecting the spawning of many species of fish.

Many estuarine areas have been subject to the gradual destruction of wetlands through filling for urban development. The once productive San Francisco Bay has been reduced by approximately one-third through land reclamation operations. Wetlands, now recognized as "powerful biological engines," produce many of the organic nutrients so necessary for the maintenance of the estuarine ecological system. The extensive, well-established Chesapeake Bay wetlands must be protected, now, from shortsighted land-use patterns.

The great size of Chesapeake Bay, its little understood physical, chemical, and biological parameters, and the effect which rapidly increasing population and urban-industrial development have on the estuary, make necessary for the preservation of the rare body of water a specialized study. Realizing this, the Congress directed, in section 312 of the River and Harbor Act of 1965, that a complete study of Chesapeake Bay be made by the Corps of Engineers, and that, as a part of this study, a hydraulic model of Chesapeake Bay be constructed in the State of Maryland.

The Corps of Engineers, with the advice and support of many Federal agencies, the States concerned with Chesapeake Bay, and a number of educational institutions of outstanding competence in Bay-oriented research, has prepared preliminary plans for this authorized study of Chesapeake Bay.

These plans take cognizance of the extreme complexity and reaction potential within the Bay to the man made environment, and well note that no single political or social entity can have the requisite personnel, equipment, and technical know-how to accomplish the many specialized studies needed for such a comprehensive investigation.

Fortunately, the required expertise does exist among the many agencies which historically have been responsible for certain features of water resource development.

The proposed Chesapeake Bay study is a comprehensive estuarine study. It is multidisciplinary in scope, encompassing the engineering as well as the physical, biological, and social sciences. The study is being managed by the district engineer, Baltimore, Md., whose staff is experienced in managing resource development studies of a size comparable to the magnitude of the Chesapeake Bay study. Comprehensive planning experience in many disciplines has been developed and strengthened over time by intense involvement in diverse studies.

But on the whole, this effort is not moving forward to the degree it should, because of lack of funds. This indicates to me that the importance and survival of this great estuary as a biological, productive entity has not been considered in its relative urgency.

The specific objectives of this study are to:

First. Make a complete investigation and study of water utilization of the Chesapeake Bay Basin.

Second. Formulate a long term sound water-land management plan for the development and use of the Bay area's resources, with special attention to improving the economic and social well-being of the people of the Chesapeake Bay area.

Third. Define an early action program, setting forth those elements which require prompt execution in order to: first, prevent deterioration of the Bay's resources and environment, and second, meet present needs.

Fourth. Make recommendations for carrying out the plans and programs, including institutional arrangements, cost sharing, and management of the Bay's resources.

It is intended, further, that the study develop a mechanism by which the plan recommended for optimum development of the area can be subject to review and revision as changing conditions require.

A major difficulty confronting the formulation of a rational plan of management is a serious lack of quantitative data. Never has an adequate inventory of the Bay resource been attempted. Little quantitative data are available concerning the physical, chemical, and biological characteristics of the Bay and the capacity of the Bay to support its own natural functions as well as the diverse and often destructive activities of man. This serious lack of perspective of the Bay environment in its present uneasy relationship with a rapidly expanding urbanized environment is probably the most dangerous existing threat to the Bay system.

A logical plan of study directed toward development of a comprehensive plan must include many parameters because, for whatever purpose the Bay is used, such use affects all other purposes. There is a need for a coordinated management approach to developing and preserving the resources of the system. Although the States of the Bay area support a number of progressive agencies which have regulatory and management functions in Chesapeake Bay, there is no single agency that is actively engaged in an overall multistate planning effort directed toward the maintenance, enhancement, and rational utilization of the Bay resources.

This complete study of water utilization and control, involving the largest estuary in the Nation and its spectrum of complex problems, is expected to yield significant knowledge of many important physical, chemical, biological, and social phenomena of importance not only to Chesapeake Bay, but to other estuarine areas. This study undoubtedly will improve the environmentalist's ability to estimate the effect of man's works on estuarine ecology, based on the development of a methodology to determine realistically the carrying capacity of these important resources.

As a part of the Chesapeake Bay resource study, a hydraulic model of Chesapeake Bay, together with a technical center for Bay studies, is planned for construction at Matapeake, Md.

Thus far, the research activities which have been completed and those in progress, have established the Chesapeake Bay region as a world center for estuarine research. However, as work has progressed, it has become readily apparent that a jump in basic and applied engineering research capability is necessary.

Currently available investigative and analytical techniques have provided much valuable assistance in determining the gross physical operating characteristics of the Bay system. However, the time is past when unilateral problem solutions based on judgment, available but inadequate technology, and reconnaissance type data are of use to the Chesapeake Bay community.

The hydraulic model of Chesapeake Bay will provide the necessary steps to the scientific and engineering problem solutions so urgently required now.

Most of the problems confronting the Chesapeake Bay are not and cannot be subject to rigorous mathematical analysis. The hydraulic model is an absolute necessity for continuing the economic, scientific and engineering study for the preservation of the Bay.

Some of the important uses of the model are:

First. Determination of the salinity distribution in the Bay system, and how it is affected by both natural events and the works of man.

Second. Determination of the mechanics of estuary flushing, the characteristics of waste dispersion, and the potential waste assimilation capacity of the Bay.

Third. Location and evaluation of erosion and sedimentation problems.

Fourth. By analogy, the effects of certain processes, both of nature and of man, on some biological characteristics of the Bay.

Fifth. Determination of least hazardous site location for underwater outfalls, thermal power station, and so forth.

At the request of the House Appropriations Committee a reanalysis of the study was completed during fiscal year 1969. The revised cost estimate for the Chesapeake Bay resource study is approximately $15 million.

A conservative estimate of the combined yearly value of both the commercial and the sport fishery of Chesapeake Bay is $100 million. If we were to capitalize the fishing industry at $100 million a year at 4⅝-percent interest for 50 years, we would arrive at the astronomical sum of $18.6 billion. The total cost of the proposed Chesapeake Bay resource study is less than one-tenth of 1 percent of $18.6 billion.

It must be remembered that the fishery resource of Chesapeake Bay represents only a small portion of the total value of the Bay.

Process, procedure, and habit have been developed and applied for so long without thought to actual or potential impact on our environment, that many areas have already been reduced to an intolerable pollutional morass. This is doubly tragic as the technology to study and abate has been readily available. We cannot allow ourselves to be reduced to a State of self-pity, and possibly self-destruction. We must use our technical and scientific resources.

It is imperative that lead time on Chesapeake Bay be generated before we are forced into agreement and action by catastrophe. We simply must assume the responsibility to make this important study, develop rational management schemes, establish a viable management mechanism, and bring to a halt the steadily increasing deterioration of the Bay resource.

It is impossible to overemphasize the fact that, as the quality of the environment deteriorates, so does the quality of life. We must stop fouling our nest, for at the very least, it will soon become uninhabitable, and at the very most, nonexistent.

Recognizing the problems, and lip service to them, is no longer enough. Action is the only answer.

Mr. LENNON. The gentleman from Virginia—since you were here early this morning.

Mr. DOWNING. Thank you, Mr. Chairman.

I want to compliment the gentleman on his statement. I might say the gentleman need not worry that he does not have specifics. You have such weight. By that, I mean national influence. If you just said, "I am for it" that is a considerable recommendation of the bill.

Thank you, old friend. You made a good statement.

Mr. MORTON. Thank you, sir.

Mr. LENNON. I agree with the statement. I am delighted to have you here.

Mr. Pelly?

Mr. PELLY. I think our colleague on a number of occasions has been late in coming to these committee hearings as I was this morning, and will pardon me because he knows that often we have constituents or other important matters which prevent us from being here on time. I am glad I did get here. I have read your statement and I commend you for it.

I was thinking while you were concluding your statement of the hearing which the Fish and Wildlife Subcommittee held yesterday on legislation to provide the President with a Council on Environmental Quality to advise him somewhat the way he receives economic advice from a committee of economic advisers. This Council would advise him on the overall matters that plague us due to overpopulation and industrialization; the very thing that the speech you made on the floor of the House addressed itself to. I have become convinced that such council would be very helpful to the President.

I think, the administration possibly is opposed to this and supports the idea that you can have an intergovernmental group composed of the Cabinet members do this type of work. I think they are too busy.

I do not see you very often these days, I might say, and I am asking you now that I have caught up with you, to look into that matter and possibly if you have a chance help in solving your own problems on Chesapeake Bay on a national basis by lending your support to such legislation.

Mr. MORTON. I appreciate the remarks of the gentleman from Washington. I would like to say this: I think the President has acted wisely in asking Dr. DuBridge, his principal scientific adviser, to bring together this Council. I think there is a recognition everywhere, in the State governments, in local governments, and certainly in the Federal establishment, that we are not staying ahead of the fact as far as environmental management is concerned. As the civilization and society becomes more sophisticated, the consumption of the environment takes on awesome proportions and the waste products of our industrial effort, of our agricultural effort, and of man himself have not been managed through the years in a way that prevents certain resources, namely the air and the water and others, from being consumed rather badly.

So I think as a first step to advise the President and as a focal point for recognition of the problem, the Council on the Environment is very appropriate.

I have great faith in Dr. DuBridge. In fact, I am going to meet with him this afternoon to discuss this very thing. I heard him speak recently on this topic, and his great understanding of it is so clear that I hope to have some of it rub off on me.

One of the things that has not been mentioned is the necessity for a concerted congressional approach to environmental matters. We all know that nearly every standing committee in the Congress, deals with some facet of environment management—housing, transportation, this committee, the Committee on Interior and Insular Affairs. I am not so sure that as a first step, in the form of the congressional patterns themselves, that there should not be some coming together in the form of a joint committee, or a select committee dealing with the environment.

Mr. PELLY. I think that has been suggested and possibly even legislation introduced, but my fear is that in the executive branch the different departments will avoid treading on other departments' toes, and that, if you are going to try to correct the terrible situation in the country due to the pollution of our environment, that you are going to have to have some overall group and not just count on the Cabinet members or departments of government to work together.

I received, and I think every member of this committee received, a most elaborate brochure from the Department of the Interior on marine

sciences and it seems to me that its purpose was to persuade us to keep much of the responsibility for oceanography, that might under other recommendations go to an independent agency in the Department of Interior. So it is going to be difficult, and I am glad that you are talking to Dr. DuBridge. I do not know anybody that has more interest in this whole subject than you have and I appreciated the opportunity of working with you. That is why I am particularly glad to catch up with you today and say that I hope you will give some thought to the program which is before the Fish and Wildlife Subcommittee now.

Thank you very much, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Pelly.

The gentleman from California?

Mr. HANNA. Thank you, Mr. Chairman.

I find it completely and physically impossible to see eye to eye with my colleague. On matters of this sort, however, and many others, he knows that we have intellectually arrived at a single point. On this testimony I find much with which I agree. I think because of your comments and those of Mr. Pelly, it is true that logic and reason is pointing us toward what Professor Bauer suggested yesterday, a beter focal point for environmental management. But my friend knows and the members of this committee know and I think Professor Bauer knows that the mind of reason is often poisoned at the spring of historic jurisdictions and mainly through the flows of jealousy that well so often therein. That is the problem which Mr. Pelly has, I think, defined.

In the interim, I think you are right that we should not wait to fight on all fronts before we push the battle forward.

I think the pattern has been established. That was start coordinating committees, advisory councils, and I would like to add one other, that is, a mission-oriented kind of interim agency, one that can get behind projects which actually develop new materials and try out types of engineering developments and have the interface back and forth.

One thing that bothers me about the National Oceanographic and Atmospheric Agency is that it does, unfortunately, leave out the reference to the land and, as the gentleman has pointed out in his very excellent statement that he made on the floor the other day, one of the problems of the Chesapeake Bay is obviously the sediments that flow off the land. We have some concerns now about the pesticides and chemicals that flow off the land and in my own area we have a reverse problem. We have these aquifiers which bring in salt water intrusions so that there is a play both ways. There is a pollution of the land in certain oceanic areas by the ocean and there is a pollution of the ocean by certain land masses such as in your Chesapeake Bay.

I think that these interfaces and the interactions are important on the three points in our environment and we would not be doing a total job until we direct ourselves to a solution.

Mr. MORTON. Certainly I would agree with my friend and colleague from California. The question is, where do you grab the brass ring? How do you start? If we are going to consolidate approaches and action groups into a new concept of environmental management, first we have to perfect the pieces. Perhaps the reason we have done so little in this area is that we have not perfected the pieces. We have not developed specific action-oriented programs in various sectors of environmental managment which, at some point in time, we can put together into a total management concept.

This concept has to transcend many traditional lines. It has to transcend the concept of State management. For example, there is nothing that can be done constructively in the Chesapeake Bay unless first Virginia and Maryland agree to work together, but much beyond that unless the States that occupy the drainage basin of the Chesapeake Bay can involve themselves to protect the interests of the estuary.

So you get into regional concepts and you get into different elements, atmosphere, water, land management, erosion, flood control, pollution, waste management, and all the rest.

My only hope is that in the development of an ocean science oriented and action agency we keep in mind that what we are doing is perfecting one system, which, in time, will take its place in a total concept.

Mr. HANNA. I am delighted to hear the gentleman stress that, that this is the concept that we have to keep in mind, because I agree with you 100 percent and I think that this is what realistically we should set out now to do.

I think that the Chairman of this committee has provided the kind of leadership that is going to help us perfect this particular unit, but, also, I think we need to reemphasize, Mr. Chairman, and reexpress our total goal which would be some kind of an environmental management.

Mr. POLLOCK. Would the gentleman yield?

Mr. HANNA. Yes.

Mr. POLLOCK. Notwithstanding your opening remarks, I am delighted to see that you do see eye to eye with the witness.

Mr. HANNA. Physically because he is 6′6″ and I am 5′4″ it is impossible, but ideologically it is quite often the case.

Mr. LENNON. The gentleman from Massachusetts.

Mr. KEITH. Thank you, Mr. Chairman.

It is good to have you back here. I am only sorry that instead of going to Ways and Means you did not choose Appropriations.

Mr. MORTON. I did not know the choice was open.

Mr. KEITH. I do not know that it was, but I would assume, from your past success in achieving political objectives, that had that been your choice you could have arranged it.

Mr. MORTON. I do not know. I have always felt, Mr. Keith, although I appreciate your remarks, that before there is spending there should be revenue. Maybe this is a philosophy that only you and I share.

Mr. KEITH. Hopefully, the revenue will flow, particularly if we learn how to capitalize our indebtedness, as you outlined in your brochure here. You capitalized it over a 50-year period and talked about breaking it down into bits and pieces.

I am particularly interested in this system's approach and I am interested in this big bite that you have undertaken in the Chesapeake area.

I note a parallel interest not only in the members of this committee but in our districts. Representing as I do most of the Cape Cod Bay area and similarly the Buzzards Bay area, I am hopeful that this marine resources commission report will give us guidance that will be applicable within States as well as among them.

I am very glad to have your observations and comments and hope we will have a chance to make them a reality.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Keith.

The gentleman from Alaska.

Mr. POLLOCK. Thank you, Mr. Chairman.

I would like to associate myself with the remarks of the several members of the committee in welcoming our good friend, our old friend and former member of the committee back. I particularly appreciate the position you are in and the attitude you take with reference to this report of the commission, Rog, and I think what you have said is certainly correct.

I think there are going to be anguished cries on the reorganization proposal and we can talk about the different methods of bringing all of these separate interests together to yield and to blend into one, but it seems to me that ultimately the President is going to have to designate some one agency or some one official to pull everyone together. Otherwise, they are all going to be going in their separate directions.

As Mr. Pelly indicated with one of the departmental reports, this is a waste of energy if it is going in the wrong direction to try to separate all of them. The President has indicated that he will lend his full support and backing to the concept of the sea and we do have to make this major move you talk about. I would hope that at some point he will put his hand on somebody's head and say, "Yours is the responsibility to pull these together and I am going to look to you to do it." Otherwise, I do not think it will come into being.

Mr. MORTON. I think that is the assignment that Dr. DuBridge has received from the President. Whether it is quite as broad in scope as we would like it is a matter of debate, but this is the approach that is being used.

The unfortunate thing is that in our duties as Members of Congress—and in particular that part of our duty which prescribes that we exercise a degree of congressional oversight—we have no way to attack this problem. We have no basic staff approach to give us accurate information on what the consumption of the environment really is, and what is actually happening in the environment, the degree in which pollution is either being corrected or the degree in which it is progressing, the degree to which the air, for example, is changing in character due to input.

This is the thing that concerns me most, that we will have reports made by experts and dedicated Americans who have studied the problem and submitted a very fine document, and yet we in the legislative branch do not have any way really of dealing with the total problem.

When I think of the debates we have had on water importation and the bills we have had in various committees to deal with the subject of water distribution and many other aspects, I am always depressed that we do not have an in-house capability of measuring what is occurring on the crust of this earth as a result of our society and the activities of our civilization.

If the President and the administration can do this, maybe it will bring to light the problem; once the problem is brought to light, writing the legislation should be a relatively simple thing.

Mr. POLLOCK. I know in my own geographic district I see so often a single problem in which there are so many related approaches or attacks from different agencies and none of the problems can ever be solved unless we have an interagency approach with someone delegated the authority to bring them together and to knock the heads, if necessary, and to say, "It is going to be this way." I think this is going to be vital in this area.

Mr. MORTON. I think so. Maybe you should write a "Save Alaska Bill."

Mr. POLLOCK. I am concerned about this, also.

Mr. MORTON. You should be.

Mr. POLLOCK. We are delighted to have you here.

Mr. MORTON. Thank you.

Mr. POLLOCK. Thank you, Mr. Chairman.

Mr. LENNON. The gentleman from Pennsylvania, Mr. Goodling.

Mr. GOODLING. Just a short observation, Mr. Chairman.

I am certain it is a distinct asset to this committee to have the gentleman from Maryland on our team.

As Mr. Downing said, he can add weight in more ways than one.

Mr. LENNON. The gentleman from North Carolina, Mr. Jones.

Mr. JONES. No questions.

Mr. LENNON. The gentleman from Florida, Mr. Frey?

Mr. FREY. Thank you, Mr. Chairman.

Are you trying to say that the weight of authority is on our side?

Mr. GOODLING. Maybe so.

Mr. FREY. There is one other thing which came up in another committee and that is the complete problem of the environment in trying to tie down exactly what is the environment that we are talking about and what would really have to be grouped together in order to properly look at this subject. When we are talking about the question of pollution, someone brought out the question of population control which at first may seem to be pretty far out, but the more I thought about it the more it made sense that, really, in order to take a look at our question of pollution, there are so many factors that go into this, such as interface between the various sciences, that just a grouping of what we have today I do not think would accomplish really the purpose that we need. At most it would be a holding action.

I think the situation where we are in a holding action is not sufficient. It is going to have to be an active type of agency or an active type of commission setting guidelines and leading the way rather than just seeing where we are and collecting the problems. I take it this is the thrust of your remarks.

Mr. MORTON. I think we have gotten a little off the subject. I agree with you that we are going to have to take an active and an aggressive type of management approach to environmental matters that are all interrelated. The environment is everything. It is the court house lawn and it is the ashbin behind the garage. It is the ocean. It is the air. It is everything. But somewhere, somehow, we have to take a first step, and do this in a constructive way.

To conclude my remarks, I hope the committee will not get bogged down in the concept of total environmental management and will focus on the problems of oceanography and on the problems that are related to the scope and jurisdiction of this committee; hopefully, in doing a good job here in the field of oceanography and in the establishment of a new national policy for oceanographic activity, we would then create at least one of the molecules of this vast program. We could become over-awed by the problem and by the many interesting aspects of it and fail to bring our microscope into full focus on this one aspect. There is a legislative opportunity here to deal with this aspect, and I would simply encourage the committee to come up with a good bill and get the show started.

Mr. FREY. Thank you, Mr. Chairman.

Mr. LENNON. I thank the gentleman.

Before I recognize the ranking member of the committee, I would like the record to show that this committee on both sides of the aisle is extremely proud of the fact that the gentleman from Maryland has been a member of this committee throughout his career as a Member of the Congress up until January of this year—is that correct?

Mr. MORTON. Yes.

Mr. LENNON. And holds the high national honor of being Chairman of the Republican National Committee.

We are proud of you, Rogers, as a friend and a great American.

Now, the distinguished gentleman from Ohio, Mr. Mosher.

Mr. MOSHER. Mr. Chairman, I want to express my regret that I had to be absent for the presentation here this morning of the remarks by one of my very favorite colleagues, Rogers Morton. I had to be in the Subcommittee on Science Research and Development, which is meeting this morning with the Science Committee of the Canadian Senate. The gentlemen from across the border and we got to discussing there many of the things that this committee is interested in, certainly the ecological emphasis that has been represented in the remarks here this morning, for instance as represented in our mutual problem of the pollution of Lake Erie. Many problems across the border there in Canada are the same that we are facing in our considerations here, of the necessity for a greater impetus and a greater coordination of our Nation's efforts in the marine sciences and engineering.

Just glancing over your prepared statement, Mr. Morton, I notice several phrases that delight me; this phrase, "Now is the time for action." And "I hope the President will lend his full support." And, "This is not a partisan question." I fully agree, with those emphases, and I am sure that this committee fully agrees that, considering your party role and your great opportunity for leadership, it is particularly significant that you consider this a bipartisan issue, and to know that you fully support our bipartisan efforts here in the committee as you did as a member of the committee.

One thought, and I am not sure that it has been expressed here before this morning, because I was not here, is that I would hope that you might take advantage of your closeness to the President to discuss with him the possibility of direct executive action by Executive order to create the elements of NOAA, a National Oceanic and Atmospheric Agency, as recommended by the Stratton Commission. I think the elements of that agency can be put together, using the Reorganization Act and thus give impetus and make a very sound foundation for us to act legislatively, to add by legislation those functions that are not already authorized by statutes.

I realize that he cannot create functions in a new agency that have not been previously established by the Congress, but I think he can reorganize the presently approved functions and give us a nucleus on which then to build by legislation, to add the necessary new functions.

Mr. MORTON. First, let me thank the gentleman for his very kind remarks.

I think that this is part of the thrust of the Council that is being established now on the environment—to look not only at the physical properties of the environment, but also at the Government organization we have to deal with. Hopefully, a recommendation for a restruc-

turing of that organization will come out of the recommendations of this Council.

I would also like to put in a plea that we address ourselves to the same problem in the Congress. It seems to me we think too much in terms of congressional reform in other areas, areas that involve the system rather than the total congressional approach to problems. I think we are split apart in the Congress on this whole question of environmental management, we perhaps should come together in the way we did in the field of atomic energy and in the field of economic matters.

Mr. MOSHER. I would suggest that by reorganization in the executive agencies, the new coordination there inevitably will require reorganization and coordination of the jurisdictions of congressional committees, exactly the goal you mention.

Mr. MORTON. It is somewhat of a difficult thing to achieve, though.

Mr. MOSHER. I know.

Mr. MORTON. Thank you, Mr. Chairman.

Mr. MOSHER. It ain't easy, to use a phrase.

Mr. LENNON. Thank you, Mr. Mosher.

I think that I stated yesterday here, Mr. Mosher, that the present National Council on Science and Technology has been mandated to make a study in depth of the Commission's report and to, in turn, make their recommendations to the chief executive. We got that assurance from Dr. Wenk some 2½ weeks ago, and yesterday I received a communication, a note, from Dr. Wenk to the effect that he would be prepared, he and the other members of the Council, to appear before this subcommittee by mid-June on the subject matter with respect to their position, and I assume that it will reflect the executive's position.

Congressman, we thank you so much for your attendance and your continued interest in our problems.

Mr. MORTON. Thank you.

Mr. LENNON. Our next witness, gentlemen, has been announced.

If you will come forward—Dr. Chalmer Kirkbride, vice president of the National Security Industrial Association.

While we try to save printing costs, in order that the members of this committee may know the background of Dr. Kirkbride, and those people who may read this record, I ask unanimous consent to have inserted in the record just prior to his statement a brief biographical sketch, or résumé, of the activities of Dr. Kirkbride.

(The biographical sketch referred to follows:)

CHALMER G(ATLIN) KIRKBRIDE

Present occupation: Vice President, Research and Engineering, and Director; Member, Sunoco Operating Committee Sun Oil Company, 1608 Walnut Street, Philadelphia, Pennsylvania 19103.

Business address: Sun Oil Company, 1608 Walnut Street, Philadelphia, Pennsylvania 19103.

Residence address: 13 Elk Forest Road, R.D. 2, Elkton, Maryland 21921.

Birthplace, date of birth: Tyrone, Oklahoma, December 27, 1906.

Marriage: Billie Skains Kirkbride, April 13, 1939.

Children: Chalmer Gatlin Kirkbride, Jr., January 19, 1940.

Degrees, honors and awards: University of Michigan, B.S.E. and M.S.E., Chemical Engineering, 1930; Honorary Sc.D., Beaver College, Pennsylvania, June, 1959; Honorary Eng.D., Drexel Institute of Technology, Pennsylvania, June, 1960; Professional Progress Award, American Institute of Chemical Engineers, 1951;

Engineer-of-the-year Award, Delaware County Chapter, Pennsylvania Society of Professional Progress Award, American Institute of Chemical Engineers, 1951; ing, 1967; Founders Award, American Institute of Chemical Engineers, November, 1967; Distinguished Public Service Award, United States Navy, June, 1968.

Professional career: 1930–1934, Standard Oil Company (Indiana), Whiting. Indiana, Chemical Engineer, Research Department. 1934–1942, American Oil Company, Texas City, Texas, Assistant Director of Research. 1942–1944, Field Research Dept., Mobil Oil Co., Dallas, Texas, Chief of Chemical Engineering Development.

1944–1947, A & M College of Texas, College Station, Texas, Distinguished Professor of Chemical Engineering 1944–47, Owens-Corning Fiberglass Corporation. Newark, Ohio, Consultant. 1945–1947, Day & Zimmerman, Inc., Philadelphia, Pennsylvania, Consulting Engineer.

1947–1948, Houdry Process Corporation, Marcus Hook, Pennsylvania, Manager, Research & Development Division. 1948–1952, Houdry Process Corporation, Marcus Hook, Pennsylvania, Director and Vice President in Charge of Research and Development Division. 1952–1956, Houdry Process Corporation, Philadelphia, Pennsylvania, President and Chairman of the Board.

1948–1962, Houdry Process & Chemical Co., Div. of Air Products & Chemicals, Inc., Philadelphia, Pennsylvania, Director. 1952–1956, Catalytic Construction Company, Philadelphia, Pennsylvania, Director. 1956–1960, Sun Oil Company, Philadelphia, Pennsylvania, Executive Director, Research and Engineering Department.

4/60–Date, Sun Oil Company, Philadelphia, Pennsylvania, Vice President, Research and Engineering Department. 1/63–Date, Sun Oil Company, Philadelphia, Pennsylvania, Director. 1958–Date, SunOlin Chemical Company, New York, N.Y., Director.

2/59–5/60 Avisun Corporation, Philadelphia, Pennsylvania, President, 2/59–1/68, Avisun Corporation, Philadelphia, Pennsylvania, Director, 5/68–Date, Puerto Rico Sun Oil Company, Philadelphia, Pennsylvania, Director.

Miscellaneous business activities: 1956–Date, PMC, (Pennsylvania Military & Penn Morton), Chester, Pennsylvania, Member, Board of Trustees. 1959–Date, PMC Colleges, (Pennsylvania Military & Penn Morton), Chester, Pennsylvania, Vice Chairman, Board of Trustees. 1958–1967, Delaware County National Bank, Chester, Pennsylvania, Director.

1965–Date, The Riddle Memorial Hospital, Media, Pennsylvania, Director. 1965–1967, The Riddle Memorial Hospital, Media, Pennsylvania, Chairman, Board of Directors. 1950–Date, Professional Engineer—New York. 1959–Date, Professional Engineer—Pennsylvania. 1968–Date, U.S. Naval Academy Foundation, Inc., Member, Board of Trustees (2-Year Term).

Publications: Several papers on management, education, taxation, economics, heat transfer, multicomponent fractionation, phase equilibria, catalytic processes, and on ocean engineering. Author of 12 patents on desalting of crude oil, high pressure absorption of hydrocarbons, and catalytic processes. Author, Chemical Engineering Fundamentals, McGraw-Hill Book Company (1947).

Clubs: Chemists' Club, New York City; Delaware Turf Club; The Engineers' Club of Philadelphia; Petroleum Club of Houston, Texas; Racquet Club of Philadelphia; Union League of Philadelphia.

Fraternities: Alpha Chi Sigma; Phi Lambda Upsilon; Tau Beta Pi.

PROFESSIONAL AND INDUSTRIAL SOCIETIES—MEMBERSHIP AND ACTIVITY

American Chemical Society: 1931–Date, Member, American Chemical Society; 1947–Date, Member, Division of Petroleum Chemistry; 1947–1951, Secretary-Treasurer, Division of Petroleum Chemistry; 1962–1967, Member, Division of Chemical Marketing Economics.

American Institute of Chemical Engineers: 1932–Date, Member, American Institute of Chemical Engineers; 1946–1948—1950–1952, Director; 1953, Vice President; 1954, President; 1940–1952, Member, Chemical Engineering Education and Accrediting Committee.

1945–1947, Chairman, Program Committee; 1948–1949, Chairman, Public Relations Committee; 1950–1951, Chairman, Membership Committee; 1951, Member, Engineering Manpower Commission of Engineers' Joint Council (Representing AIChE); 1953, Chairman, Publications Board; 1953–1954, Chairman, Trustee Pension Plan; 1957–1960 Member, Trustee Pension Plan; 1955–1959, Member, Ethics Committee; 1959, Chairman, Ethics Committee; 1956–1958, Chairman, Fiftieth Anniversary Committee.

American Petroleum Institute: 1943–Date, Member, American Petroleum Institute; 1961–1968, Member, General Committee, Division of Science and Technology; 1966–1968, Member, Executive Committee of Central Committee on Research, Division of Science and Technology; 1966–1968, Liaison, API Subcommittee on Oceanography, Central Committee on Research, Division of Science and Technology and the NSIA Committee Activities on Oceanography; 1968–Date, Member, Committee on Research, Data Information Services, Division of Refining.

American Society of Engineering Education: 1946–Date, Member, American Society for Engineering Education.

Coordinating Research Council: 1959–Date, Director (Representing API); 1963–1964, Vice President; 1965–1967, President.

Engineers Council for Professional Development: 1947–1953, Member, ECPD (Representing AIChE); 1947–1950, Member, American Council on Education (Representing ECPD); 1949–1953, Member, ECPD Executive Committee.

Marine Technology Society, Inc.: 1958–Date, Member, Marine Technology Society, Inc.

National Academy of Engineering: 1967–Date, Member, National Academy of Engineering; 1967–1968, Member, Committee on Ocean Engineering; 1967–1968, Member, Panel on Energy and Resources, Committee on Ocean Engineering; 1967–1968, Chairman, Sub Panel 3–D, Petroleum Resources, Panel 3 on Energy and Resources, Committee on Ocean Engineering.

National Science Foundation: 1967–1969, Member, Panel on Sea Grant Institutional Awards.

National Security Industrial Association: 1965–1969, Chairman, Ocean Science and Technology Advisory Committee (OSTAC); 1965–1969, Member, Executive Committee, Ocean Science and Technology Advisory Committee; 1967–Date, Vice President, National Security Industrial Association; 1968–Date; Member, James Forrestal Memorial Award Committee.

Society of Automotive Engineers, Inc.: 1967–Date, Member, SAE Technical Board; 1967–1969, Member, SAE General Material Council of SAE Technical Board; 1969, Member, SAE Membership Committee for the 1969 Administrative Year.

Society of Chemical Industry (American Section): 1959–Date, Member, Society of Chemical Industry (American Section).

World Petroleum Congresses: 1951, Member, U.S. National Committee for Third World Petroleum Congress; 4/64–3/65, Member, Ad Hoc Committee for Assisting in Formulation of Program for the Seventh World Petroleum Congress; 1965–Date, Member, Permanent U.S. National Committee for World Petroleum Congresses.

Miscellaneous: 1935–1939, 2nd Lt., Chemical Warfare Service Reserve; 1946, Scientific Consultant to Secretary of War, Bikini Atom Bomb Tests; 1960, Member, Chemical Engineering Advisory Committee, Rutgers University; 1961–1965, Member, Chemical Engineering Visiting Committee, Carnegie Institute of Technology; 1962, Member, Chemical Engineering Department Evaluation, Pennsylvania State University; 1965, Member, Visiting Committee, College of Engineering and Science, Drexel Institute of Technology; 1965–Date, Member, Industrial and Professional Advisory Council, Pennsylvania State University; 1967–1969, Consultant to Marine Engineering and Technology (Panel 2), Commission on Marine Science, Engineering and Resources, Washington, D.C.

Mr. LENNON. Doctor, you have a written statement, and members of the committee have your statement in front of them. You may proceed, sir.

STATEMENT OF DR. CHALMER G. KIRKBRIDE, VICE PRESIDENT, NATIONAL SECURITY INDUSTRIAL ASSOCIATION

Dr. KIRKBRIDE. Mr. Chairman, and distinguished committee members, I would like to say, before I initiate my prepared presentation here, that I agree very much with the general statements that were made by Congressman Morton. Although he termed them as general, I thought they were very important and very much to the point.

I am happy to appear before your committee today because I want to make whatever contribution I can to expedite the implementation of

the Commission's report, "Our Nation and the Sea." I want to make it clear, however, that what I shall say represents my personal views and may not agree in all respects with the views of organizations with which I am connected.

In my opinion, one of the most important problems we face today as a Nation is the initiation of a national oceanic program vis-a-vis a Federal program. This is what the Commission recommended and I agree with them. It should be done now.

I had the pleasure of serving as a consultant to the Panel on Industry and Private Investment and to the Panel on Marine Engineering and Technology. I was very much impressed with the dedication of every member of the Commission that I met and with whom I worked. Also, I can say the same about the staff with whom the Commission surrounded themselves. I have never seen a group of men less self-serving nor more dedicated to doing a job which in their judgment was for the best interests of the United States of America. Their excellent report reflects this in every respect.

I want to confine my remarks today to what I regard as the heart of the Commission's report. Unfortunately, some segments of the press have badly misunderstood and misinterpreted this part of what the Commission recommended. The Commission directed its recommendations toward a national oceanic program, not a Federal oceanic program. Time and again I have seen statements in the press and heard over the radio and television that the Commission recommended a "wet NASA." Nothing would be further from the truth. The Commission went to great lengths in its recommendations to avoid proposing a "wet NASA."

NASA was a creation of the Federal Government to carry out the Nation's exploration of space. During the past 5 years NASA has spent at an average rate slightly in excess of $5 billion per year. Tremendous industrial growth has taken place as a result, but essentially all of this private industrial growth has occurred as a result of direct or indirect contractual relationships with NASA. NASA is 100 percent tax supported. No profitable enterprises have yet been discovered in space, and so the operations of NASA have had to be financed 100 percent out of taxes. In other words, the Federal Government has financed all the work of NASA, including that of its private industrial satellites who supply NASA with services and hardware. I have no quarrel with this. As a matter of fact, I doubt if it could have been done differently.

But, this is a long way from what has been taking place in oceanic development in the U.S.A. to date. Furthermore, it is a long way from what the Commission recommended for the future. The Commission recommended a national oceanic program, not a Federal program. To have a national program, we must have the Federal Government working in cooperation with private enterprise, with regions and States, and with the academic community.

In the case of NASA, the Federal Government has appropriated from tax money the funds needed to explore space. But in the case of the oceans most of the money has come from the free enterprise sector and has come out of profits. This is a distinction of paramount importance.

As a matter of fact, the petroleum industry alone in the past several years has contributed far more annually to the U.S. Treasury, just from its oceanic operations, than the Federal Government has spent on ocean development, excluding defense. The petroleum industry in 1968 paid $1.6 billion into the U.S. Treasury from its offshore leases and operations. Furthermore, this figure does not include corporate income taxes. In addition to this, the offshore petroleum industry has invested many billions of dollars in fixed assets in order to carry out these offshore operations. Compare this with the recommendation of the Commission that the Federal Government increase its spending for the next 10 years by an average of $800 million annually over the present $500 million rate. Even at this increased level, future Government expenditures will still be substantially less than those of the offshore petroleum industry.

If I have any disagreement at all with the major recommendations of the Commission, it is that an increase in expenditures of only $8 billion over the next 10 years is pitifully low. It is my understanding that the Federal Government spends $17 billion per year on all of its research and development programs, but of this only $500 million goes into oceanic R. & D. This is only 3 percent of the total and yet there is tremendous profit potential in oceanic development. This reflects a corresponding tax potential which the Federal Goverment should recognize.

Under these circumstances, I am amazed that oceanic R. & D. gets such a small percentage of the total. I suspect that the primary reason for this is that the Federal oceanic work is so fragmented among over 20 agencies and departments that a good case for oceanic R. & D. has never been presented to the Congress. Of course, this emphasizes the great need for a strong civil agency to administer the Federal oceanic R. & D. programs excluding defense.

The petroleum industry is the leader in the free enterprise sector, but expenditures by such industries as food, maritime, recreation, chemical and mining are also substantial. You can see then that the Federal Government is indeed a distant second when compared with the total annual expenditures by the entire free enterprise sector. The Federal Government will continue to be a distant second even with the implementation by Congress of the recommendations of the Commission. Remember that expenditures by the private sector are possible only because industry is willing to invest out of today's land-based profits in expectation of future offshore profits.

Hence, the Commission wisely recognized that in a truly national oceanic program industry would be a crucial segment. The Federal Government must recognize the vital roles of the free enterprise sector, of the States and regions, and of the academic community. A national program must have built into it organizational arrangements for obtaining information and advice from the entire marine community. Account must be taken of the accumulated knowledge and expertise from all these segments. National goals and objectives must be established with due regard to the commitments, capabilities, and long-range interests of each of these important contributors to oceanic development.

Also a course for federally funded activities must be charted that will not hinder or duplicate effort by nongovernmental sources. Finally, leadership and stimuli must be provided for continued, and hopefully

expanded, efforts by the private sector. We, as a nation, cannot afford to pay out of taxes for the investment needed to attain the full potential of oceanic development within a reasonable time period. This can be afforded only if Federal policy establishes and maintains an environment that will encourage economically sound developmental efforts by all private segments of the marine community, working cooperatively with Federal programs. An atmosphere which permits the free enterprise system to make a fair profit must be maintained if we are to have a successful national oceanic program.

The Commission has provided for this truly national approach by recommending the formation of the National Advisory Committee for the Oceans (NACO). In my opinion, this is the most important recommendation made by the Commission because this is a prerequisite to a truly national oceanic program. Despite its importance, this recommendation unfortunately has been overlooked by most of the press, and where it has been mentioned, its importance has not been emphasized sufficiently.

The members of NACO would be appointed by the President, with the advice and consent of the Senate. These members, approximately 15 in number, would come from industry, various State agencies, the academic community, and other appropriate areas and should be representative of the Nation's varied marine and environmental interests. This committee would have broad advisory responsibilities. In addition, each of the principal Federal agencies concerned with marine and atmospheric matters would designate a senior policy official to participate as an observer in the deliberations of the committee. This arrangement would permit the committee to draw readily on the expert information and views of the Federal agencies.

In my opinion a majority of the NACO members should have extensive successful industrial experience and should be drawn primarily from the users of the sea, such as those engaged in the transportation, petroleum, fishing, mining, chemical, desalination, and recreation industries. Industries supplying hardware and services should also be represented.

Too frequently in the past, such appointments to Federal committees have tended to include an overbalanced representation from the academic community. I hasten to say that I have no objection to college professors. As a matter of fact, I was one myself 22 years ago. Even so, colleges and academic institutions have not taken the lead in pointing the way to exploitation of the oceans. They are not doing most of the research in this field. Industry is far ahead of the academic sector in the number of qualified men it has available to lead the way to successful exploitation of the oceans, and it is far better informed on what new technologies are needed for a successful national oceanic program.

I will admit that I am biased, but I am strongly convinced that the great majority of the members of NACO had better be thoroughly experienced in the free enterprise programs for exploitation of the sea. Otherwise, the chances are that NACO will be a miserable failure, and if NACO fails, the proposed national oceanic program also will fail.

The Commission recommended that NACO advise the head of a new agency to be created, National Oceanic and Atmospheric Agency, which I shall discuss later, but very significantly, NACO would also report

to the President and to the Congress on the progress of both governmental and private oceanic programs in achieving the objectives of the national oceanic program. Such a report would be furnished biennially and made public. NACO would offer guidance and recommendations on long-range goals and on means for achieving them and would seek to insure that optimum use is made of the capabilities and contributions that can be furnished by all sectors.

Note, however, that NACO would be an "advisory" committee. Offering good advice does not guarantee a Federal role which will stimulate a truly national program for effective use of the seas—particularly not when our nonmilitary Federal programs are presently fragmented among so many different departments and independent agencies. The Commission has, therefore, also recommended quite properly, in my opinion, the creation within the Federal Government of a strong independent civil agency with adequate authority and adequate resources to organize and conduct appropriate nonmilitary governmental programs to stimulate a strong national oceanic program responsive to the needs of all segments of the marine community. Specifically, the Commission recommended a National Oceanic and Atmospheric Agency (NOAA) reporting directly to the President. In my opinion this is the second most important recommendation made by the Commission. It would bring together the U.S. Coast Guard, the Environmental Science Services Administration, the Bureau of Commercial Fisheries, and the national sea grant program plus certain other smaller oceanic-oriented Government organizations. By giving this agency sufficient size it will be able to undertake successfully the Federal civilian oceanic responsibilities encompassing science, services and fundamental or multipurpose technology development. NOAA would then be able to present an adequate case for oceanic R. & D. so that a more equitable portion of the total R. & D. funds would be allocated to the national oceanic program.

As mentioned earlier, the National Advisory Committee for the Oceans would furnish advice and counsel to the Director of NOAA. As a result of the recommended consolidation of much of our Federal oceanic activities, NOAA would be able to direct effectively a substantial portion of our nonmilitary efforts as required by the agreed-upon national program.

In addition, as the Commission points out, a major benefit of establishing a strong operating marine affairs agency would be the opportunity to assign the head of NOAA the responsibility for interagency planning and coordination. This would be done at the direction of the President. In my opinion this is the third most important recommendation by the Commission.

This means that the Director of NOAA would have a second responsibility, namely, chairman of the newly constituted interagency mechanism. Agencies with marine interests that are outside of NOAA, such as Interior, AEC, Smithsonian Institute, NASA, Army Corps of Engineers, yes and the unclassified Navy programs would also be included. This additional assignment to the director of NOAA would be completely consistent with the broad mission of NOAA. Unfortunately, this dual responsibility of the head of NOAA has also been largely overlooked by the press.

The interagency mechanism would be primarily for the purpose of information exchange rather than administration. I doubt seriously that it would be feasible for the Director of NOAA to have any administrative control over the oceanic programs coming within the sphere of the interagency mechanism. The real accomplishment to be achieved by having the Director of NOAA act as chairman of the interagency mechanism is to minimize duplication of effort. For example, unclassified technology being developed by the Navy could be made available to other organizations within NOAA or within the interagency mechanism if such technology were applicable.

There is a real need for such an organizational procedure to avoid duplication of projects. At the first David Taylor Model Basin meeting of the Ocean Science and Technology Advisory Committee of NSIA, September 20–24, 1965, it was discovered that there was substantial duplication of oceanic projects of the Federal Government. Even the Government people who participated in this meeting were embarrassed to learn for the first time about the excessive duplication of effort. Hence some procedure must be established to avoid duplication of effort in the future. The proposed interagency mechanism under the chairmanship of the Director of NOAA provides the minimum necessary safeguards. Also, in my opinion, it would be well for the Director of NACO also to serve on the interagency mechanism—perhaps as vice chairman, though I don't have any strong feeling there.

One more item of interest: The major result of this arrangement is that advice by NACO to the head of NOAA would, in effect be advice to all Federal organizations with marine activities. Thus, through the organizational relationship of NACO, NOAA and the interagency mechanism, we could do much to insure sound national planning and program direction.

Let us realize that we need a truly national program for effective use of the sea—one that involves and is responsive to the needs of private interprise, States and regions, and the academic community, as well as to various Federal bodies. Let us agree, also, that the Federal role should be one of leadership and stimulation, providing an environment for maximum involvement of private enterprise in economically justifiable oceanic programs. Unless this is achieved, our exploitation of the oceans will fall far short of what is possible. Most of the money for exploitation of the oceans must be generated from profits—not from taxes. Otherwise, the national oceanic program will be a failure. This is in sharp contrast to our exploration of space through NASA. It is true that the Federal oceanic program will be financed out of taxes. Even so, I would consider that the national oceanic program has fallen far short of what it should achieve if the taxes paid by industry derived from its oceanic program do not exceed the amount spent by the Federal Government on its oceanic program.

Thus, to provide the proper background and guidance for the decisions necessary to achieve the goal of a national oceanic program, the Commission recognized the need for and recommended the creation of the National Advisory Committee for the Oceans. The success of a national oceanic program will be directly dependent upon just how well NACO performs its responsibilities. To achieve a truly na-

tional oceanic program will be difficult at best, because the free enterprise sector must be induced, not coerced, to cooperated. This can be done effectively only by establishing an atmosphere that provides the necessary profit incentives. It cannot be done by demanding and directing through legislation the wholehearted cooperation of the free enterprise sector. Remember, industry is by far the largest of the four sectors that must work together cooperatively to achieve a successful national program.

The creation of NACO and NOAA simultaneously is the essential beginning for Congress in implementing the recommendations of the Commission. There are some recommendations that could be delayed, such as the one pertaining to redefinition of the Continental Shelf. Debate on such recommendations should not be permitted to hold up the implemention of other essential proposals.

The first step is the simultaneous creation of NACO and NOAA. Then the national oceanic program can get underway promptly.

Thank You.

Mr. LENNON. Thank you, Doctor.

And while I think about it, I would appreciate it if the members of the staff would furnish to Dr. Stratton and Sam Lawrence, and other members of the Commission who may be in the Washington area, as well as to the witnesses who have testified so far, a copy of Capt. Paul Bauer's statement yesterday which is, in substance, in opposition to the creation of NOAA. And, in the future, any witnesses who appear, I would appreciate it if the staff would see that after they present their statements, or before, if you like, that they likewise be furnished with a copy of Captain Bauer's statement. All of us recognize how important it was to have early in these hearings a statement such as Captain Bauer's with his long experience and expertise in this field in order that those segments of the marine sciences which are interested in this program would have an opportunity to get his point of view and they may want to articulate on his point of view at a later day and Captain Bauer would have an opportunity to come back before the committee and state his views on any matter that has been presented by any witness either pro or con for the subject matter.

Mr. POLLOCK. Mr. Chairman, would you yield on this point? I think this is an excellent idea and it has occurred to be in listening to these several really outstanding witnesses and the major contribution and certainly tremendous effort that they have put out here that somehow these well though out, well documented messages should be made available to the President. In each case when I read, as I did Mr. Kirkbride's statement, this morning, I think this is really excellent and the President ought to know the views of these people.

Mr. LENNON. To continue on the record, suppose we do this: Inasmuch as the National Council on Marine Science and Technology are charged with the responsibility of advising the President with respect to its positions on the Commission's Report, suppose we send to Dr. Ed Wenk copies of the statements made by all of the witnesses and we will not wait until they all finish because they will pile up, but will send them about every week and, say, Mr. Counsel, that it was the consensus

of the members of our committee that the Council should be furnished with this testimony in their consideration of the recommendations they are going to make to the President.

Mr. POLLOCK. I think that would be wonderful.

Mr. LENNON. If there is no objection to that, gentlemen, we will proceed in that way.

I will come back with questions later after we go around.

The gentleman from Ohio, Mr. Mosher.

Mr. MOSHER. Mr. Chairman, I find myself without any significant questions of Dr. Kirkbride, but I do want to say that I think his is a very significant statement. I like the emphasis in it, particularly the emphasis on the fact that our goal should be a national program as distinguished from strictly a Federal program. I like his emphasis on the extremely important role of private industry and the free enterprise system.

I agree with him that the popular use of the phrase "wet NASA" is not an accurate phrase as applied to the proposed NOAA. In fact, I think it is a very unfortunate phrase in that respect.

I agree with him where he suggests that we should not get bogged down at this point in technical arguments over the definition of the Continental Shelf, that we have more important things to discuss at this point.

I agree with him that if there is any criticism to be made of the Commission's report it is the fact that it is rather modest in its goals. However, in the dollar comparisons, you are making at the bottom of page 3 and the top of page 4 just for the sake of accuracy, let me raise this question: I think when reference is made to the spending by the Federal Government of $17 billion on all its research and development programs annually, it is my understanding that that figure includes military research and development.

Dr. KIRKBRIDE. Both figures do.

Mr. MOSHER. Well, I do not think so. I think the proposal in the Commission report purposely leave out some of the Navy's potential expenditures here. This may be a misunderstanding on my part, but I understood that the proposed dollar goals in the Commission report include only part of the Navy's expenditures.

Dr. KIRKBRIDE. Both statements are correct. I hadn't caught up with this and I asked Dr. Wenk to provide me with the figures. I am appalled to find that the percent of Federal funds going into Federal marine programs goes up at the startling rate from 2.6 percent in 1967 to 2.8 in 1969. He tells me that the figures which started out $438 million in 1967 and climbed up as high in 1969 as $471.5 million include that part of all the Navy's research and development program that applies to the ocean.

The situation is that the amount of funds devoted to defense in the ocean is pretty small in the overall total. In other words, the big part of the Navy program that he emphasized—and frankly, I really shouldn't be parroting Dr. Wenk because you can get this information directly from him, and I am sure you will, but I was rather shocked to learn that most of the Navy R. & D. is directed to other areas outside of the marine sphere.

(The data provided by Dr. Wenk at the request of Dr. Kirkbride follows:)

MARINE SCIENCES BUDGETS IN RELATION TO TOTAL FEDERAL R. & D. BUDGETS

[In millions of dollars]

	1967	1968	1969
Total Federal (including marine):			
Basic applied research	5,358	5,150	5,254
Development	10,727	10,716	10,700
R. & D. facilities	638	606	891
Total R. & D	16,723	16,472	16,854
Federal marine programs:			
R. & D	209.8	245.4	248.3
Operations	124.4	130.9	145.4
Facilities	103.8	55.5	77.8
Total marine	438.0	431.8	471.5
Percent of total Federal	2.6	2.6	2.8

Mr. MOSHER. That well may be, and I did not want to quibble over these figures. I think it is something that our staff might investigate for purposes of our own understanding in the committee.

I suggest, Mr. Chairman, that we should clarify some of those dollar figures and their significance, but, to repeat, I agree that if any criticism is valid of the report it is that it is too modest.

I am not prepared to argue which of the recommendations is most important, first, second, or third.

Dr. KIRKBRIDE. I told you I was biased.

Mr. MOSHER. I think all of these recommendations are very important including the recommendation for a National Advisory Committee for the Oceans, which you place as top priority.

Whether it is top priority or not, it is a very important priority.

Mr. LENNON. In that connection, Mr. Mosher, on page 252 of the Commission's report we find this language:

In particular, it should be noted that the estimates for Department of Defense programs have been provided only for selected activities which relate intimately to civil functions.

Without objection, I am going to ask unanimous consent that that entire paragraph of the Commission's report be inserted in the record in connection with your colloquy with the witness because it is relevant.

(The paragraph referred to follows:)

In particular, it should be noted that the estimates for Department of Defense programs have been provided only for selected activities which relate intimately to civil functions. The Commission has assumed that Defense support for marine science and technology will continue to expand in response to military needs and has not attempted to project the costs which may be incurred in carrying forward their marine-related military programs. Funds for such other special-purpose activities as the shellfish sanitation program of the Public Health Service and the Atomic Energy Commission's studies of the use of nuclear technology for harbor excavations have also been excluded from the estimates.

Mr. LENNON. Now, the gentleman from California?

Mr. HANNA. Thank you, Mr. Chairman.

I want to compliment the gentleman particularly on stressing this point about a national program. I think that was a very significant

point. I would like to turn to the point which you raised about the efforts of private enterprise in this field and the amount of money that they are putting into it as compared to the public moneys.

It raises a point that I wanted to make and I think I will make it right here with your slight opening of the door by that statement.

I am quite concerned that exploitation and extraction of the resources of the sea do not follow some of the sorry history of exploitation and extraction on the land. I have come to the conclusion that there are three types of subsidy that occur, subsidies precedent, which is in the money that the Government makes available for R. & D. along with private enterprise. There is simultaneous subsidy in which we cooperate with private enterprise in achieving an end, and all of these are well known; but the third kind of subsidy is only now beginning to make itself known and that is subsidy subsequent. When the extraction and exploitation creates cumulative burdens which are left out of the assessment of the true cost, you have false profits and you have a disjunction between the people who get the benefits and the people who have the burdens.

The most dramatic expression of that was in a story that came out of Wales where they have been extracting coal out of the ground for a long time and piling the tailings on the hillside and that day, with an accumulation of tailing and just the right amount of rain, it all slipped down the side of the mountain, wiped out the trees, wiped out the houses, and wiped out a school containing over 200 children.

So, in my judgment, that was a price that was paid for the extraction of coal which had never been entered into the books and it was visited upon those who had none of the benefits directly from the activity.

It appears to me that we are beginning to get to the point where we are trying to think this through, and I think that is why the idea of getting a broader based advisory committee is important, getting it on a national basis and getting us out of what I spoke of yesterday to Dr. Bauer about this tunnel vision and the wells of activity in which we do not take any responsibility for or any account of some of the cumulative factors of load, of burden, which ultimately somebody has to pay for. Since we now have to pay to clear the river and the people who put that pollution in the river never carried on their books anything to pay for that and the taxpayers are going to pay for it, so we have here a prime example of susbsidy subsequent.

I think that the gentleman has pointed out that we have to have included in our structure for this activity that kind of input which will take into consideration this historical experience.

Am I correct in interpreting what you are saying?

Dr. KIRKBRIDE. I agree with that philosophy; yes, sir.

Mr. HANNA. I would certainly hope that one of the inputs that we can provide in these hearings is the ringing message that we understand now that this is part of the responsibility of a committee of Congress in expressing the policies and the aims in any program. I think with the expressions that have previously been made that you have contributed a great deal to our hearings on this matter, and I congratulate you for it.

Thank you, Mr. Chairman.

26-563—69—pt. 1——11

Mr. LENNON. Thank you, Mr. Hanna.

The gentleman from Washington.

Mr. PELLY. Dr. Kirkbride, first let me commend you for upholding free enterprise. It is refreshing in this city of bureaucracy to have somebody come here and speak up for the concept which made this country great and brought about the prosperity which we enjoy.

Mr. PELLY. There is one matter that I cannot refrain from asking you about and that is your suggestion for a redefinition of the Continental Shelf. I think the definition which is included in the International Convention of 1958, was the one that you referred to, was it not?

Dr. KIRKBRIDE. Yes.

Mr. PELLY. It bothers me, and I know it bothers a lot of members, that we might redefine the Continental Shelf in such a way as to abrogate some of our sovereignty in the area of 200 meters depth and beyond where we can exploit it. I myself, do not feel that it is fuzzy like the State Department always tells me when they come back from talking with the United Nations. I think the definition is pretty clear, and I do not know quite whether you as a supporter of free enterprise favor turning over our Continental Shelf to underprivileged countries for the international good or some such thing. It seems to me that we had better stick fast by the definition we now have.

Dr. KIRKBRIDE. Well, in my statement what I was trying to convey was that I did not think that we should allow the redefinition of the Continental Shelf, which is one of the things the Commission did recommend, to take precedence over the three things that I think are the heart of the report. Whether you define the Continental Shelf of today or 5 years hence, I don't think matters.

Mr. PELLY. I hope it will be firming up the ownership of the Continental Shelf.

Dr. KIRKBRIDE. The thing I was trying to highlight is that there are three important things that the Commission recommended and let's not let the other things that they recommended confuse the issue.

Mr. PELLY. I think we are going to need that kind of advice when we really get into this with all the pressures one way and the other and all the jealousies which will come to the surface.

I, for one, appreciate your statement here today. I think it has added a lot to the record.

Dr. KIRKBRIDE. Thank you.

Mr. LENNON. The gentlemen from Alaska.

Mr. PELLY. There is more Continental Shelf off of Alaska than any other State.

Mr. POLLOCK. We have 64 percent of it.

Mr. PELLY. What is good for Alaska is good for the State of Washington.

Mr. POLLOCK. That is what I hear.

Sometimes my colleague and I differ on fisheries rights for the State of Alaska so that his statement is not as valid then as it is at the moment.

I might say that your statement is excellent. You evidently put in a lot of hours, you or someone did, on your behalf.

Dr. KIRKBRIDE. I had a lot of help.

Mr. Pollock. I use every opportunity as I go to different parts of the country to talk about this area because it is one that is near and dear to my heart. I have to give you fair warning now that I will be plagiarizing your good report. I think it is excellent.

Dr. Kirkbride. I would be flattered.

Mr. Pollock. As I read through this and listen to your testimony, and I suppose every person who has come to testify before the committee, and certainly the members of the committee share this, I try to find the ways that implement the Commission's recommendations. We can see what needs to be done, and I think you heard Congressman Rogers Morton earlier talking in the area of how we bring this about. I think we have an excellent study and I think it is time we get on with the job, and any contributions that you or anyone else can make toward helping us find the right solution to implement this thing will be most welcome and I think most rewarding. I happen to be a private enterprise enthusiast, and I like your approach and I think particularly your report ought to be shown to the President. I think it is very, very fine.

Dr. Kirkbride. Thank you, sir.

Mr. Pollock. Thank you, Mr. Chairman.

Mr. Lennon. The gentleman from Florida, Mr. Frey.

Mr. Frey. Thank you, Mr. Chairman.

I also would like to say I agree with my colleagues on this and certainly our approach to it.

I did want to make one comment about the space program, as another member of the committee. I am sure you did not want to in any way slight the tremendous spinoff we have had from the space program. And I am sure you are aware of the spinoff that is helping oceanography and really it is pretty hard to separate.

Dr. Kirkbride. I certainly agree with you there. I think this is true of any research and development you do. I have been in research and development for 39 years now and, frankly, I see this all the time, that you start out to work on a certain problem and you get certain scientific information that doesn't apply to that problem particularly but applies to another problem; and this is the important finding that you have been able to achieve. This has taken place throughout our space program.

I didn't intend to slight that in any way.

Mr. Frey. I am sure you didn't. I just wanted to point that out for the record.

There is one other question on this line of reasoning that has interested me and it has bothered me as I see such an interrelationship between the various sciences and between the work of the various committees. Under the proposed council setup, does it appear to you that it will be an adequate means of collecting this various data not just from the field directly related to oceanography, but from related fields.

Dr. Kirkbride. I certainly am not an expert in bureaucratic organization.

Mr. Frey. Good. Then I would like your answer.

Dr. Kirkbride. During the time that I served as a consultant, I can recall coming over to this building, I believe—at least it is the building where Mr. Rogers has his office, and consulting with him on how

we might set up such an arrangement. This is one of the things that the gentleman who is going to follow me, Admiral Stephan, and I had some impact on the Commission, I believe, in setting up NACO. The thing is that I know the way we are doing it now isn't right and these are the things that have to be done.

How you put them together I haven't the slightest idea, and I don't envy you the problem. But it is a problem that you have to solve. I am not an expert.

Mr. FREY. Thank you, sir. I appreciate your remarks.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, sir.

Doctor, we appreciate very much your statement and hope that your interest will continue, as I am sure it will.

Now, Counsel?

Mr. DREWRY. Dr. Kirkbride, you mentioned three priority items, the three most important things in the report. I have heard on the outside that you favored the legislating of NACO irrespective of NOAA. Your statement doesn't say that. You say you want NACO and NOAA simultaneously. I wonder if maybe the question of the priority might be the thing that has caused the confusion. You do favor NOAA and NACO simultaneously?

Dr. KIRKBRIDE. Yes, sir.

Mr. DREWRY. But you feel that they are necessary to each other and that maybe, without NACO, NOAA could fail and, therefore, you assign first priority to NACO? I am thinking about your early remarks as they came out in the press, and I wanted to help you spell them out.

Dr. KIRKBRIDE. This is the situation. As I mentioned, I don't know anything about organizing in the bureaucratic setup as you are faced with it. Consequently, I can have very firm and very hard, fast feelings about this and I can talk very authoritatively, but my statements on this would not mean very much.

Originally I did have that viewpoint that NACO could be set up separately but after reviewing this with a number of the members of the Commission, and these gentlemen are really smart and they devoted an awful lot of detailed attention to this, I have come to the conclusion that it would be a bad gamble to set up NACO by itself. It might be shot down in political flames, before you got an organization such as NOAA for it to hide behind.

Mr. DREWRY. As I say, I had heard that.

Dr. KIRKBRIDE. I have changed my views.

Mr. DREWRY. I see what you are saying here, that you felt that they should be simultaneous.

Dr. KIRKBRIDE. They are dependent on each other. They complement each other.

Mr. DREWRY. The question was posed to Dr. Stratton, and he very strongly felt and was supported by the other Commission members that NACO should not exist prior to NOAA and that they couldn't be in the same kind of relationship to the Council that we have to NOAA. I just wanted to clear up something in my own mind.

Thank you very much.

Dr. KIRKBRIDE. Thank you, sir.

Mr. LENNON. Thank you very much, Doctor.

Hopefully we can proceed with our next witness even in the absence of many members of the subcommittee in order to keep our schedule.

Off the record for a minute, please.

(Discussion off the record.)

Mr. LENNON. Admiral Stephan, with your 40 years of experience since you graduated from the Academy I believe in 1929, you ought to give us a quick preference: Would you like to proceed here and go as far as you can and maybe we can complete your statement today, or would you like to come back Tuesday. Which would be your preference?

Admiral STEPHAN. Gentlemen, I prefer to come back Tuesday.

Mr. LENNON. All right, sir.

Let me announce the program for next Tuesday. We have two witnesses scheduled for Tuesday, May 13, Dr. Eric Walker, president of the National Academy of Engineering; and Mr. Northcutt Ely, attorney, representing the American Bar Association.

Mr. HANNA. From California.

(Discussion off the record.)

Mr. LENNON. Then we will proceed with the Admiral as the leadoff witness.

Thank you very much for your attendance, and we look forward to seeing you again next Tuesday.

The committee will stand in recess until that time.

(Whereupon, at 11:50 a.m., the subcommittee recessed, to reconvene at 10 a.m., Tuesday, May 13, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

TUESDAY, MAY 13, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:10 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. The meeting will please come to order.

We are resuming our hearings on a thorough review of the Marine Science Commission Report "Our Nation and the Sea."

The subcommittee will recall that on the 7th of this month we were fortunate in having as our witnesses our colleague, Hon. John B. Anderson, followed by Prof. Paul S. Bauer, distinguished scientist and former very able consultant to this Subcommittee on Oceanography.

During Congressman Anderson's testimony, he was questioned concerning certain matters in Professor Bauer's statement. Since he had not had the opportunity to either hear Professor Bauer, or read his statement, the Chair asked Congressman Anderson to take a copy of the statement and at his convenience give the committee the benefit of his comments.

Under date of May 9, the Chair received a letter from Mr. Anderson and in view of the background, it has been duplicated and copies are in the folders of each of the members.

At this point I would like to ask unanimous consent, and, since there is no one here to object to it, I expect we will be able to get unanimous consent that immediately following the statement by Mr. Anderson and the subsequent questioning of him by the members, that there be inserted in the record at that point a letter addressed to the Chair under date of May 9, the letter from Congressman John D. Anderson in which he responds to the statement made by Captain Bauer.

(The document referred to follows:)

HOUSE OF REPRESENTATIVES,
Washington, D.C. May 9, 1969.

HON. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Merchant Marine and Fisheries Committee, Longworth House Office Building, Washington, D.C.

DEAR MR. LENNON: I again wish to thank you and your distinguished Subcommittee for giving me the opportunity to testify before you on the Stratton Commission report. As you may recall, at the time of my appearance I was asked to comment on the testimony of Captain Paul S. Bauer. Not having seen an advance copy of his testimony, I was unable to do so at that time. But I have now perused his statement and am now prepared to make a few observations for the record.

First I can sympathize with Captain Bauer's advocacy of a comprehensive environmental approach. I would agree that it is difficult to separate the land from the sea-air environment. But as advisable as it is to move in the direction of such an approach, there is an immediate need to turn our attention to a national oceanic effort, and NOAA addresses itself to this need.

Secondly, I beg to differ with Captain Bauer's statement that NOAA "would result in the Interior Department being no longer concerned with the Marine environment!" (p. 3 of Bauer's statement) This is not the case and I attempted to point this out in my testimony. If I might quote from the Commission report: "The Commission rejected the idea of consolidating all Federal marine and atmospheric functions into a single, massive organization. Some such functions which will remain outside NOAA are integral to the agency which performs them . . . (these include) the marine-related water management programs of the Department of Interior." (p. 232, "Our Nation and the Sea")

Captain Bauer also implies that NOAA would either take over the Geological Survey or duplicate its efforts. I have been informed by a staff member of the Marine Council that neither would occur. The Coast Geodetic Survey and U.S.G.S. would complement one another and this would be assured by the interagency coordinating mechanism within NOAA.

Fourth, I am disturbed by Captain Bauer's statement that the removal of the Bureau of Commercial Fisheries from Interior to NOAA, "would be a disastrous step backwards." (p. 5) He fails to explain why the Bureau would be any less effective under NOAA. The Commission report suggests that, "The rehabilitation of U.S. fisheries . . . depends upon good sea science and new, improved marine technology to define, locate, manage and harvest the living resources of the sea," and that, "The combination of marine commercial and sport fishing functions in NOAA will best accomplish these objectives." Mention is also made of the necessity to bring aquacultural research for both plant and animal species under the single management of NOAA so that, "coordinated planning can take place to develop the full potential aquaculture offers." (pp. 239–240, "Our Nation and the Sea")

I think this approach is most vital if we are to fully realize the food resource potential of the oceans. By bringing together the aquaculture research functions of BCF and the National Sea Grant Program and by providing a focal point for industrial advances in this area, we will be moving one step closer to solving the imminent food problem our world faces.

Thank you for allowing me to comment on Captain Bauer's statement. He has provided a very provocative and controversial viewpoint which I am sure will enable your Subcommittee to proceed with a broader perspective on the problem.

With best wishes, I am

Very truly yours,

JOHN B. ANDERSON,
Member of Congress.

This morning we have the great pleasure of hearing as our first witness Rear Adm. E. C. Stephan, U.S. Navy, retired, former Oceanographer of the Navy. I ask unanimous consent at this point that there be inserted in the record immediately preceding Admiral Stephan's statement a biography or résumé of his splendid background. I might announce too, that inasmuch as the Rules Committee is sitting this morning at 11:15 at which time several of us are involved in presentation to the Rules Committee of the maritime authorization bill, no other witness except Admiral Stephan was scheduled this morning.

(The document referred to follows:)

REAR ADM. EDWARD C. STEPHAN, USN (RET.)

Vice President Ocean Systems, Inc., Affiliate of Union Carbide Corporation and The Singer Company (1964–1969).

Chairman Marine Resources Council, Nassau Suffolk Regional Planning Board (1967–1969).

Consultant to Engineering and Technology Panel of National Commission on Marine Resources and Engineering Development (1968).

Member of Multiple Use of Coastal Zone Panel and Ocean Exploration and Environmental Services Panel of the National Council on Marine Resources and Engineering Development (1968).
Member Oceanography Advisory Committee for Oceanographer of the Navy (1968–1969).
Chairman the Committee on Offshore Power Application of the Atomic Industrial Forum (1968–1969).
President Marine Technology Society (1964–1966).
Chairman Oceanography Committee, Nassau Suffolk Regional Planning Board (1964–1967).
Chairman Deep Submergence Systems Project—U.S. Navy (1963–1964).
Oceanographer of the Navy and Commander U.S. Naval Oceanographic Office (1960–1963).
Member Interagency Committee on Oceanography (1960–1963).
Commander South Atlantic Force, U.S. Atlantic Fleet (1958–1960).
Chief of Legislative Liaison and Congressional Relations Navy Department (1951–1953 and 1956–1958).
Commander Amphibious Squadron Two, U.S. Atlantic Fleet (1954–1956).
Chief of Staff Submarine Force, U.S. Pacific Fleet (1953–1954).
Graduated from U.S. Naval Academy and career in U.S. Navy, primarily submarines (1929–1953).

Mr. LENNON. Admiral, if you will come forward and proceed with your statement, I will promise you I will try to ask some questions in the absence of some of our members. We are delighted to have you before us again.

STATEMENT OF REAR ADM. E. C. STEPHAN, U.S. NAVY (RETIRED)

Admiral STEPHAN. My name is Edward C. Stephan. I appreciate the opportunity to appear before you as a citizen who is enthusiastic over the capability of the ocean and its resources to make great contributions to the solution of current and foreseeable national and world problems.

I am also enthusiastic over the Commission report which you are now considering. I would like to help in finding ways to implement the Commission's recommendations and maintain the momentum which the outstanding job done by the Commission has provided.

Any compliment to the Commission is also praise for your committee, for surely the Congress, and this committee in particular, played the major role in the establishment of the Commission whose excellent report is now before you.

I have studied the Commission report, particularly those sections relating to national and Federal organization for the realization of national goals in the ocean. I have not had the opportunity to study the panel reports but plan to do so now that they are available.

In my opinion, the largest obstacle in the way of a well-organized and well-funded national program in the ocean is the confusion that has existed, and continues to exist, with respect to similarities and differences between the ocean program and those of defense and space.

For the past 30 years, the Congress, the executive branch, industry, and the States, in fact, the entire Nation have been heavily involved, even to the state of preoccupation, with all aspects of defense and space. Many people now holding high office in Government or industry cannot remember when the economics of a depression, not defense or space, was the primary object of our concern and of our scientific, technological and administrative efforts.

This long continued concern with defense and space has generated a tendency to organize other programs of a technological nature in much the same way that space and defense are organized. As this committee will remember, early bills to organize a national ocean program were concerned only with the Federal structure. It was at your initiative that provision was made for the major roles of the States and industry in the ocean program in Public Law 89–454. This, of course, led to the Commission whose report you are now considering.

Let us get back to the similarities and differences between the defense and space programs on the one hand, and the ocean programs on the other.

Generally speaking, defense and space may be paired for comparison with oceanography. Scientifically and technologically speaking the interface between space-defense and oceanography is quite close and space-defense provides very valuable spinoffs to oceanography.

For example, miniaturized instruments, digital recording, telemetering, and precise positioning, all essential to and paid for by space-defense, have very important oceanography applications. Similarly, the science and technology of submarine location and identification, essential to defense, have direct ocean application in fisheries and other areas. The same may be said for such defense systems as the antisubmarine warfare environmental prediction system.

On the knowledge-engineering side space-defense are closely related to the oceans but here most similarity ends. On the organizational and budgeting-financial sides, space-defense are totally different from the oceans and this difference is very frequently not realized.

Organizationally speaking, space and defense are totally Federal programs and the national program is indeed almost completely the Federal program. The States are involved in space and defense only to the extent of providing real estate and facilities. Industry, at least certain areas of it, is involved heavily, but only as a contractor to execute the Federal programs of a narrow segment of the Federal Government—the Department of Defense and NASA.

This situation in space and defense where the Federal program is, in fact, the national program simply does not exist in the oceans. In the oceans there is and must be a strong Federal program, but it is spread across a wide range of eight or more Federal departments and some 30 agencies instead of being concentrated in two as is the case with space and defense.

In the oceans, at least the 30 ocean or lake coastal States not only have major marine resource opportunities but they also have very serious pollution and conflicting marine utilization problems which they must solve on a State, county, city, or even smaller political jurisdiction basis. The States are deep into the coastal zone of the ocean or lakes in a much more complex and a potentially much more rewarding way than just providing real estate and facilities as they do in space or defense.

As important as the State involvement in the oceans, and currently more financially rewarding to both the States and the Federal Government, is the involvement in the ocean of U.S. industry, particularly the oil, fisheries, pollution control, recreation, and mining industries. These industries are involved in the execution of Federal program contracts but they are much more importantly involved in the execution of their own programs in pursuit of profit.

The investment of these industries in ocean programs is enormous. The revenues paid to Federal or State treasuries by the oil industry from offshore exploration and production totals much more than the total Federal investment in nondefense oceanography.

I have tried to emphasize the fact, that in the oceans, the Federal program is only a part and not the major part, of the national program. The national ocean program requires therefore a very different organizational approach from the totally Federal space and defense programs.

The Commission recognized this and recommended a national advisory committee on the oceans, NACO, to facilitate strong State and industry inputs to the Federal program in order to provide a sound national program. I strongly support this recommendation for NACO. I believe NACO is at least as important as the Commission recommended National Ocean Atmospheric Agency NOAA, if we are going to increase the efficiency of the Federal role in the national ocean program.

The Commission emphasized the need for a National Ocean Atmospheric Agency and I certainly hope some sort of NOAA will be established but I am not qualified to speak as to the details of its composition. I do feel strongly that some more efficient organization of the civilian ocean oriented agencies of the Federal Government must be achieved for many reasons not the least of which is to provide a more effective means of bringing together the Federal civilian agencies to receive the tremendous contribution which military, principally, Navy, oceanography/ocean engineering can make to total Federal programs and thus to total national programs.

In my opinion, the Navy's tremendous resources of men, ships, facilities, and operational and research know-how must be brought into the total picture unless we are to go to the ridiculous expense and nearly unsurmountable administrative task of transferring a capability the Navy now has to a civilian agency which today simply does not exist.

The fact that a broadening of the Navy mission and separate funding for its nonmilitary program role may be required does not change the overall urgency to use Navy capabilities in the total Federal and the total national ocean programs.

Much has been said of the difficulties which may be encountered in establishing NOAA. I believe it may be even more difficult to establish an effective NACO. We have a great deal to learn about smoothly interfacing industry and the States with the Federal Government. We must learn how to do this if we are going to have a really strong national ocean program.

I suspect we are also going to have to learn to do this when we try to get Federal, industry, and States working together in urban renewal, crime prevention, and poverty programs. Our experience in establishing national ocean program coordination may help in these other important and complex areas.

The urgency to improve Federal, State, industry, cooperation is here and I believe we should start immediately to work toward establishing NACO.

Earlier I said that oceanography was very different from space and defense in both the organizational and the budget/finance sense. I have

discussed the organizational differences and now let us turn to the budget/financial differences.

Defense, for the billions invested in it, discharges the prime responsibility of the Federal Government—national security. It is impossible to put a value on national security but the enormous dollar cost is measurable. Space for the billions that have been put into it has provided enormous national prestige and tremendous technological advances with many outside of space applications. The returns of space are great and hard to evaluate but the dollar outgo is again measurable.

Now, turning to oceans, the outflow of funds at the Federal, State, and industry level is moderate and measurable. The ocean returns contribute to space and defense as well as national prestige and to other technological spin-offs. But the ocean program also brings in very large measurable dollars.

As I have said before, the inflow of ocean dollars to State and Federal treasuries exceeds the oceanography outgo from them. Regardless of the overriding importance of defense and the tremendous values of space, it must be conceded that oceanography alone among the three is an overall dollar maker, financially.

If national defense and space programs may be likened to essential and valuable financial endowments, then the oceans may be likened to an investment in a proven profitmaker. Such a profitmaker deserves in the interest of the country and its taxpayers every encouragement to flourish.

The very important difference between space and defense and oceanography from a financial point of view brings me to the third organization recommendation of the Commission. The Commission in very general terms recommended improved congressional organization for oceanography.

I believe that financial considerations as well as the organization difficulties of Federal-State-industry national ocean program argue for stronger than subcommittee jurisdiction over the oceans on the legislative side of Congress. To my mind, committee or joint committee legislative status is deserved. On the appropriation committee side, I think there is general agreement that Federal ocean programs, and in turn national ocean programs, have been handicapped by the diffusion of ocean program budget consideration across a number of appropriation subcommittees.

The ocean program is an overall profit to national as well as State treasuries and we should be organized to enjoy and enhance the luxury of priming a pump. I believe everyone joins me in hoping that you in the Congress will act soon to improve the congressional organization for the ocean program in both the legislative and the appropriations committee areas.

I believe the National Commission on Marine Science Engineering and Resources and also the National Council on Marine Resources and Engineering Development deserve special praise for the emphasis they both put on the coastal zone in their recent reports.

It is in the coastal zone that the financial returns of oceanography are being realized. It is in the coastal zone that pollution problems are critical and must be solved if the marine environment is to make its contribution to urban renewal and a better life for the often impoverished areas of our cities near the waterfront.

It is the coastal zone which today is offering jobs not only for the scientist and engineer but also for the technical school and high school man who has the physical qualifications to work in the sea. It is at the coastal zone where international cooperation to overcome the knowledge gaps that stand in the way of estuarine management and planning in densely populated estuarine areas in our own country or in Europe, Asia, South America, or Africa will not be encumbered by sticky problems of international rights and ownership.

Finally, at the coastal zone we take advantage of the step down nature of the ocean as we concentrate on the vital, accessible and resources loaded near shore area and lay the knowledge foundation for our involvement in the deeper ocean in the years to come.

To summarize, I recommend the following:

1. Close attention to organizational and fiscal differences between the ocean program on the one hand, the space-defense programs on the other.
2. Early establishment of a strong NACO.
3. Establishment of a strong NOAA with particular emphasis on the importance of using Navy capabilities in the Federal civilian programs and in the overall national program.
4. Upgrading the stature of oceanography in the Congress on both the legislative and appropriation sides.
5. Immediate emphasis on the coastal zone.

This committee faces the problem of building on the fine job done by the Commission which you did so much to create by your role in the enactment of Public Law 89–454. Improved Federal ocean organization—innovation and improvement in Federal, State, industry ocean cooperation— and strengthening of your own congressional ocean overview have all been urged upon you.

It is a large order but returns in the form of not only dollars into the treasuries, but very major contributions to the solution of problems of this country and the world are the rewards your leadership should capture from the oceans.

Thank you for the privilege of appearing before you.

Mr. Lennon. Thank you very much, Admiral Stephan. You commented earlier that you had not had the opportunity to study the panel reports but planned to do so now that they are available. Certainly I hope that you will have an opportunity to review those and study those in the apparent depth that you have the Commission report. Hopefully we can persuade you to come back and comment on the conclusions and findings and recommendations from the several panel reports.

I am very impressed, admiral with what you say in your statement with respect to the question of how do we relate, how do we compare in cost and in ultimate human burden the programs related to space. Incidentally, I am reminded that there are actually six members of this subcommittee that are members of the space committee but unfortunately absent this morning, due to the fact they are marking up a bill. I am pleased too, in the few hearings that we have had that so much interest has been demonstrated by the members of this subcommittee on this report, especially those members of the space committee. They are quickest to differentiate between what the responsibilities are and what the ultimate goals should be.

I notice in your statement on the last two lines of page 1 and the first three lines of page 2 that you say "Many people now holding high office in Government or industry cannot remember when the economics of a depression, not defense or space, was the primary object of our concern and of our scientific, technological and administrative efforts."

That is certainly true as I look about me and see that new generation in the executive branch of the Government and in the legislative, and I won't say as to the judicial yet but maybe that time will come. There are so few people here in Government who felt the brunt of the depression and the economics of it and at that time we were more concerned with that than with either defense or space.

That was the primary object of our concern and our administrative efforts. All that has changed.

One of our witnesses a few days ago emphasized the creation of NACO and to a degree withheld his total support of the Government Federal structure indicated by NOAA.

I think counsel at that time, as I recall it, raised the question with that witness, if by any chance the committee should become stymied in its efforts to bring out a governmental structure comparable to that recommended by the Commission, was it the judgment of the witness that we ought to move in the direction of the advisory committee on the oceans known as NACO or are they so interlocked or interdependent that you couldn't have one without the other.

I would appreciate your comment on that, Admiral Stephan.

Admiral STEPHAN. Well, the optimum I think, is to get both NOAA and NACO at the same time. I think you can argue that you would have a stronger NACO if you had NOAA at the same time. But, realizing the problems of an NOAA, I would certainly like to see NACO started as soon as possible. I don't think it will be perfect when it is started as I think we have an awful lot to learn in the area of State coordination. In order to keep the momentum that this Commission's report has started, I think any one of the three organizational steps that can be taken should be taken rather than to wait until you had perfection. I think such a wait would put off any action too long and we lose the momentum furnished by the Commission report.

I think congressional reorganization, establishment of the advisory committee or NOAA, any one that you can proceed with, should go ahead and it would be better to fit them together later than to just do nothing until you get everything.

Mr. LENNON. I take it, sir, from what I have heard you say, that you are implying at least that if there was established a National Oceanography Atmospheric Agency or a NOAA as it has been described, that it could not reach its ultimate without the advisory commission.

Admiral STEPHAN. That is right.

Mr. LENNON. On the other side, I think you are saying too, as I interpret your statement, that if NOAA was brought into being, that it would be like the night following the day to bring forward and to establish your Commission. Now, without NOAA, would you articulate with respect to what could be accomplished with simply the creation of the Commission?

Admiral STEPHAN. I think if you established a commission you would first of all start bringing a number of the State representatives in. I work a good part of the time up on Long Island in connection with their problems of pollution control. I find it very difficult in the

Federal structure to find out what is going on in other States. I think it is very essential that we have a clearinghouse for State activities in the pollution area in order to prevent individual localities from going to the expense and effort of inventing the wheel several times.

I think if you had a NACO now you would, one, start getting better coordination among States and, two, NACO would be looking at the Federal structure and I think would be updating the recommendations of the Commission as to their views as to how the Federal structure ought to be organized.

I think that NACO now would work fairly well with the present Council and at least point out what both industry and the States thought that the Federal program should be doing. So I think that an NACO now, while it wouldn't be as perfect as it might be later on when it was meshed with NOAA, would serve a very useful purpose in giving guidance to the Federal Government's reorganization and to the Congress with respect to the problems they have.

Also it could start bringing the 30 coastal or Great Lakes States together in working on their in-shore environmental problems.

Mr. LENNON. Now, Admiral, with the extension for another year of the National Science Council, certainly it is imperative that if the life of the National Science Council expires approximately July 1, 1970, that there must be some, if not a Government structure, a Government advisory commission that would cover all of the spheres of the ocean marine sciences to hold them together.

I think you will agree with me that you will recall a problem that arose concerning the establishment of this National Council on Marine Resources and Engineering Development where the administration first objected to it on the philosophy that it would mean simply that you would have people serving on that Council who would in turn replace the old interagency ad hoc committee on oceanography and some of us took the position at that time that the difficulty with interagency committee on oceanography was that it was not a policymaking level and we believed that we ought to have at this high echelon in Government this National Council.

We did review the minutes of all of their meetings to see what their attendance was and at what level they attended those meetings and what took place in them, and that is the reason why many of us, in fact every member of this subcommittee joined in the introduction of legislation to extend the life of the National Science Council.

Like you, I am completely convinced that the National Advisory Committee ought to be one of the very first things that this committee approves of, because I think it is one that we can do, without consternation or conflict. I don't think there will be any objection on the part of anyone at any level of Government or out of Government that such an Advisory Committee at the national level should be established by appointment of the President.

In reading the Commission's report they call on us to establish this National Advisory Committee and go on to say that "The committee should be composed of individuals drawn from outside the Federal Government and should be broadly representative of the Nation's marine and atmospheric interests. The members of NACO, approximately 15 in number * * *"

That leads me to this question: if such a National Advisory Committee were appointed by the President from outside the Federal

Government and with the advice and consent of the Senate and NOAA is not established, wouldn't we need to continue the National Council on Marine Resources and Engineering Development as it is presently constituted with the Vice President as chairman and the Cabinet officials constituting the members of the National Science Council?

Admiral STEPHAN. I certainly think you would. I think that you would have to keep that Council until you——

Mr. LENNON. Brought into being a Government structure of some kind.

Admiral STEPHAN. For this Advisory Committee to interface with——

Mr. LENNON. If you established a National Advisory Committee exclusive of the Federal relationship, with private enterprise, laboratories and universities, who would they have to go to if you didn't have the National Council?

Admiral STEPHAN. I guess they would have to go back to the ICO, the interagency committee, but I think that would be a much weaker place for them to interface than your Council.

Mr. LENNON. Suppose in the act establishing the National Advisory Committee or Commission, was given the authority to counsel with and consult with and advise, to a degree at least, a National Science Council? What I am thinking about is the input from the private sector to the Federal level. If you have out here a National Council or a National Advisory Committee composed of 15 individuals outside of Government, I don't know that the National Science Council would sit down with them and listen to them and be willing to take their advice, but I could see the necessity for it.

How would you bring them together? That is one of the things that we must keep in mind.

Admiral STEPHAN. Well, I have a feeling that, if there was this strong Advisory Committee and if they reported to the Executive Branch and particularly if they also reported to the Congress, I believe that the Council would sit down with them because there are many different views as to what the Federal Government should be doing and I think that the Federal Government would welcome this input from both the States and industry as well as the scientific community that they would receive from this Advisory Committee.

I think that there could be more formal ways for giving strength to the committee established but I have the feeling that the Federal Government would welcome this input just as apparently the Council has welcomed the report of the Commission and is paying serious attention to it.

Mr. LENNON. I am, of course, speaking of the National Council on Marine Resources and Engineering Development. I want to make that crystal clear that that is what I have reference to. In summarizing your recommendations, I wish you would address yourself, Admiral, in general terms to what you mean by each of these "Close attention to organizational and fiscal differences between the ocean program on the one hand, the space-defense programs on the other."

Could we get in the record just what your thinking is on that subject?

Admiral STEPHAN. What I am driving at is that I don't think that a "wet Nasa," which I am sure that the Commission didn't intend, is the right Federal organization for the oceans and I think there was a tendency in this direction. Mr. Chairman, as you know early in the days when oceanography was considered, to pattern an ocean organization along the general lines of space and defense and I think this should be avoided if you are going to have a truly national program with the States and industry playing their main role in the oceans.

Mr. LENNON. Would you comment on your third summarization of your recommendations "Establishment of a strong NOAA with particular emphasis on the importance of using Navy capabilities in the Federal civilian programs * * *" Just how would you implement that recommendation?

Admiral STEPHAN. Well, I think that it is a problem for the Navy as it is with anyone else, to work with the diffused ocean program across the civilian branches of the Federal Government. If this were concentrated in any way then the interface and the contributions which the Navy can make, which are enormous, could be more efficiently made. It is difficult to try to coordinate with the seven or eight Federal departments and the 30 some agencies rather than coordinate with some central group.

I think the Navy feels this. Their participation and contribution would be larger.

Mr. LENNON. The gentleman from North Carolina, Mr. Jones.

Mr. JONES. Mr. Chairman, no questions, but I would like to commend the Admiral for a very fine statement. I am certainly impressed with your past experience. I recognize, you as an expert on this subject.

Admiral STEPHAN. Thank you, sir.

Mr. LENNON. Thank You. The gentleman from Massachusetts.

Mr. KEITH. Thank you, Mr. Chairman. Admiral, it is good to have you here, and I am sure that you are familiar with my direct interest in this whole question. I would like to elaborate a bit upon the recommendations that you have made. You would name it, the National Advisory Committee on the Oceans, as would the Commission. Yet your testimony indicates that you really intend that it should work on atmospheric matters as well. The name doesn't imply that, but the supporting language seems to. Do you believe that sufficient stress is given to the atmospheric aspect?

Admiral STEPHAN. Mr. Keith, I think ultimately that the atmospheric interests and the oceans will be tied closely together. I recognize that in their NOAA they specifically mentioned that that name includes the National Atmospheric Agency. The NACO is the National Advisory Committee on the Oceans. Even if the atmosphere weren't brought in at this time I think it would be a tremendous step forward if you just had an Advisory Committee on the oceans.

How you will perfect this in years to come, I think you would have to leave for the future, but we seriously lack now a place where industry and the States can interface with the Federal program in the oceans. Atmosphere, I presume is the same way, but I think we would be making a step forward if this Commission were just an ocean commission initially. How it grew and how it included the atmosphere later on, I think we would have to leave to the future.

Mr. KEITH. You might be interested to know that Dr. Walter Orr Roberts, who heads the Boulder Observatory and is probably one of the leading scientists on the atmosphere is going to be testifying before this committee on, I think, May 27, and can help our thinking in that respect.

In 1966 I visited Dr. Federoff, who as you know is the Russian representative to the United Nations in the field of oceanography. He told me that in the United States practically every known fact pertinent to oceanography could be found in some agency, somewhere. But, he said, that there is just no way to find it and therefore it's useless to us. This agency that has been suggested would go a long way toward providing that means of storage and retrieval. It might well give us a more effective role in the field of diplomacy, in areas where oceanographic knowledge is involved.

I guess that I have no further questions that haven't been or won't be explored. I am sorry that I haven't been able to be here for all of your testimony. Thank you, Mr. Chairman.

Mr. LENNON. Thank you, sir. The gentleman from Michigan, Mr. Ruppe.

Mr. RUPPE. I have no questions, thank you.

Mr. LENNON. Counsel has a question.

Mr. DREWRY. Do you think, Admiral Stephan, that it would perhaps strengthen NACO and make its relationship to the Federal organizations even stronger or smoother if there might be some Government representation on it?

Admiral STEPHAN. I think that you have to be careful that the Government representation doesn't sort of overwhelm the non-Government representation. I think there certainly ought to be Government participation in helping NACO establish its position.

In other words, NACO ought to be able to turn to the Government and find out what their programs and their capabilities are. I think Government ought to be available to NACO. I think that certainly Government should comment on the NACO recommendations but I think that the States and industry should come to Government with what they think Government should be doing in order to support the national program which includes not only the Federal Government but the States, the industry and the scientific community.

I think you have to be a little careful. How you fit Government in, I don't know exactly, but I think you have to be careful about it.

Mr. DREWRY. I think maybe the essence of the problem here is that you can't truly put all the elements of any single environmental area into a nice hardlined box on an organizational chart. I have heard it expressed that if NACO were purely in the private sector in spite of the fact that NOAA had to take direction, they could find themselves in the position where they are indeed directing this without the familiarity and knowledge of the Federal problems that should be considered, too.

I guess this is something that we will just have to feel along with as we go because of course there is an area that is mentioned in Dr. Stratton's statement and in the report that while NOAA does not propose to include all ocean related activities of the Federal Government, that nevertheless there must be some means of communication and coordination between them.

So then they recommend a sort of an additional step in there to handle this fuzzy area. I heard the thought expressed that in that fuzzy area it might wind up with NOAA dictating to Federal agencies that are not consistent with NOAA as to programs they should be conducting.

Admiral STEPHAN. Well, I think, Mr. Drewry, that as to everything you say, that it is more difficult to organize a national ocean program than it is to organize a national defense or space program, because we have a lot to learn and we are going to have to have some growing pains in getting this thing organized, but in my judgment this all argues for making a start in any way that we can toward this.

Mr. DREWRY. Dr. Kirkbride mentioned that he thought that NACO should be rather light on the academic area, that the industry area is doing vastly more and is vastly more cognizant of the real practical problems of the oceans. Do you have any comment on that?

Admiral STEPHAN. I don't think I know enough to speak in a qualitative sense but I think that there is a tremendous contribution which the scientific community can make and how you would balance that with the essential input from the States and the essential input from the industry, I don't think I could be specific on.

I think you probably would find that as it got going you would learn something and maybe it would change a little bit as the thing worked, but I am urging that we start and then perfect it as we go along rather than wait until we know all these answers.

Mr. DREWRY. Should it be a rotating body? It probably should, shouldn't it, with the membership changing from time to time rather than to risk the rigidities that might come about by having a fixed membership.

Admiral STEPHAN. If the industry representatives would be picked by the industries, they would have some problems in selecting them, but, if they had a strong group that was generally doing a good job for industry, then I think as long as they were doing a good job and industry was satisfied that it was being well represented, I would sort of leave that to industry and I would do the same thing for the States and the academic community.

In other words, what we want is know-how and strength and I don't think it is too important whether you rotate them or not, but you ought to leave it free for them to do a good job of representing the segment that they purport to represent.

Mr. DREWRY. The real big objective is to find the focus, however it is structured for marine oriented activities which presently are rather widely fractionated in agencies and institutions and everything else. I would like to just echo what I think the chairman was saying a few moments ago, that as these hearings proceed I like to think that all of the witnesses who appear before us will consider themselves part of the total team to try to put together the kind of organization and the program that we sense that we want, because any witness that we have had and will have will all have a tremendous background and their own views may change as our testimony comes in.

Maybe a second look somewhere along the line will either change your mind about something or will solidify some thinking that you were sort of uncertain about in the first place.

Admiral STEPHAN. Mr. Drewry and Mr. Chairman, I think it is a pleasure for all of us to work with this committee and we all want to help in every way we can.

Mr. DREWRY. I have no further questions, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Counsel. Admiral Stephan, I think you were present at the time when Captain Bauer testified the other day, were you not?

Admiral STEPHAN. No, sir. I was not. I read his statement.

Mr. LENNON. Have you been furnished a copy of his statement?

Admiral STEPHAN. Yes, sir; I have.

Mr. LENNON. I am not going to take your time, but I wonder if you would respond to the statement made by Captain Bauer in a letter addressed to the chairman of the subcommittee as Congressman Anderson did.

Admiral STEPHAN. Yes, sir.

Mr. LENNON. Hopefully you can give time to make some study of it in depth and give us your basic fundamental views and your judgments on the statement made here by Captain Bauer. Would you do that?

Admiral STEPHAN. Yes, sir.

Mr. LENNON. Then I ask unanimous consent that the statement to be furnished by a letter addressed to me as the chairman in which Admiral Stephan will respond to my request, be inserted in the record immediately following his statement and also immediately following the colloquy between him and members of the committee including the chairman.

(The information follows:)

OCEAN SYSTEMS, INC.,
Reston, Va., May 14, 1969.

HON. ALTON LENNON,
Chairman, Subcommittee on Oceanography, House Merchant Marine and Fisheries, Longworth House Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: In the course of the hearings on 13 May, you asked me to comment on the recommendations of Professor Paul Bauer relative to the assignment to the Department of the Interior of the federal ocean responsibilities which the Commission recommended be assigned to NOAA.

I have studied Professor Bauer's very fine testimony and have great respect for his knowledge of the oceans and his viewpoints on federal ocean organization. Nevertheless, I believe the Commission recommended solution of a new Federal agency; NOAA, is preferable to Professor Bauer's proposal.

My viewpoint is based on the following considerations:

(*a*) Creation of NOAA would encourage much needed Congressional organizational improvement in the area of the National Ocean Program.

(*b*) NOAA would provide a better interface with the commission recommended and urgently needed National Advisory Council on the ocean than would the Department of Interior.

(*c*) The Department of Interior by definition, has very great responsibilities that are in no way ocean related. Placing overall Federal Civilian ocean responsibilities under the Department of Interior would not give the National Ocean Program either the status or the clear identification it deserves and urgently requires.

Thank you for the opportunity to present my views to your committee. With highest respects and very best wishes.

Sincerely,

E. C. STEPHAN,
Vice President.

Mr. LENNON. Let me announce at this time what the schedule will be for the committee tomorrow. We are going to have Dr. Thomas C. Kavanagh, Chairman of the Committee on Ocean Engineering, National Academy of Engineering and Mr. John H. Clotworthy, President of the National Oceanography Association. We look forward to hearing these distinguished gentlemen and I hope, Admiral, that you will have an opportunity as you indicated earlier to study the Panel's reports because we would like very much for you to comment on one or two of those in the future and we will be in touch with you.

Admiral STEPHAN. Thank you, Mr. Chairman.

Mr. LENNON. Thank you.

With that the committee will stand in recess until tomorrow morning at 10:30 a.m.

(Whereupon, at 11 a.m., the subcommittee recessed until 10:30 a.m., Wednesday, May 14, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

WEDNESDAY, MAY 14, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:55 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. We are going to convene the meeting this morning which was originally scheduled for 10:30. I might comment that this is my third committee meeting since 8:25 this morning. That is an explanation for the lack of attendance.

This morning we are honored to have Dr. Thomas C. Kavanagh, the Chairman of the Committee on Ocean Engineering of the National Academy of Engineering, and Mr. John H. Clotworthy, President of the National Oceanographic Association.

I am not in a position to say that we can go after 12 noon because there is legislation on the floor that requires the attendance of most of the members.

Before we call Dr. Kavanagh, I would first like to call on a colleague, the Honorable William M. Colmer.

STATEMENT OF HON. WILLIAM M. COLMER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MISSISSIPPI

Mr. COLMER. I appreciate the opportunity to make this statement regarding oceanography and its effects upon the State of Mississippi.

As you know, Mississippi, and particularly my congressional district which contains all three coastal counties in our State, is highly orientated toward water resources development. We in Mississippi feel that we are in a most unique position because of our natural geographic location and resources to offer a great deal to the development of the oceanography field.

The coastline of Mississippi is 70 miles long. On this stretch many outstanding developments are already in existence such as the Ports of Gulfport, Biloxi, Pascagoula, and Hancock County. Also established are the Gulf Research Laboratory at Ocean Springs, the Bureau of Commercial Fisheries at Pascagoula, the U.S. Seabee Unit at Gulfport, the NASA test facility on the western side of our coastal area and numerous industrial developments across the entire coastal stretch that deal in various fields of water related activities.

We feel, of course, that the development of oceanography in Mississippi would further benefit the State. It can mean new industries in

our State, improvements in Mississippi-based fishing industries, an enhancement in the natural beauty and resources of the coastline, an improved educational program as particularly relates to the many established institutions in the coastal region, significant economic growth for the entire State of Mississippi and an enhanced national image as a focal point for Oceanography in this country.

I, therefore, support a strong, sound oceanography program and I believe I can speak for the citizens of my section of the country in offering their full support to this program.

Thank you.

Mr. LENNON. Thank you Congressman for a very brief, but informative, statement.

Dr. Kavanagh, if you will now come forward and make your presentation, please, sir.

I would like to have inserted in the record, at this point, with the consent of the members present, the biography of Dr. Kavanagh, which will precede his statement.

(The biography follows:)

BIOGRAPHY OF THOMAS C. KAVANAGH

Dr. Thomas C. Kavanagh has been a partner in the New York consulting firm of Praeger-Kavanagh-Waterbury, engineers-architects, for the past 16 years. Before his present association he was professor of civil engineering at the Pennsylvania State University, and chairman of the Department of Civil Engineering at New York University. Even now he continues to serve as adjunct professor in the graduate school of Columbia University, to help bring professional practice into the academic area.

His professional interests center on the planning, design, and construction of heavy structures—buildings, bridges, tunnels, foundations, stadiums, waterfront facilities, highways, subways and transportation systems, nuclear powerplants, radio telescopes, hardened underground facilities—and his work has received many major awards. He has carried out or supervised research in several structural fields and has published some 40 papers.

His interests extend over a broad range of activities, into such fields as ocean engineering (he is chairman of ASCE's Technical Council on Ocean Engineering, and chairman of the National Academy of Engineering's Committee on Ocean Engineering); into research (as a member of the Building Research Advisory Board and the ASCE Research Council on Performance of Full-Scale Structures); into education (as a member of several university and ASEE advisory boards; into esthetics (as a gold medalist of the Architectural League of New York); and into systems work (as a member of the Consulting Engineers Council Committee on Systems). He is vice president of the Metropolitan Section of ASCE, and was first chairman and a founder of the Met Section Structures Group.

Dr. Kavanagh is a founding member and the treasurer of the new National Academy of Engineering, a fellow of the American Society of Civil Engineers, and a member of the National Society of Professional Engineers, the American Institute of Consulting Engineers, the American Society for Engineering Education, the International Association for Bridge and Structural Engineering, and many other professional organizations. His membership in honor societies includes Sigma Xi, Tau Beta Pi, Chi Epsilon, and Phi Beta Kappa.

Born in New York, he was educated in schools and colleges there and at the Technical University of Berlin, Germany. He holds the degrees of B.S. and M.C.E. from City College, New York, and M.B.A. and Sc. D. (Engineering) from New York University.

Mr. LENNON. I think each of the members has before him a copy of the statement that Dr. Kavanagh will use primarily in his appearance.

Doctor, if you will proceed, we are delighted to have you.

STATEMENT OF DR. THOMAS C. KAVANAGH, CHAIRMAN, COMMITTEE ON OCEAN ENGINEERING, ACCOMPANIED BY DR. S. RUSSELL KEIM, EXECUTIVE SECRETARY, COMMITTEE ON OCEAN ENGINEERING, NATIONAL ACADEMY OF ENGINEERING

Dr. KAVANAGH. Thank you.

First, may I take this opportunity to introduce Dr. Keim, who is Executive Secretary of the National Academy of Engineering's Committee on Ocean Engineering. Dr. Keim is sitting at my left.

I would also like to introduce a member of our committee who is with us today, Mr. Elmer P. Wheaton of the Lockheed Corp., who is also president-elect of the Marine Technology Society and chairman of one of our panels.

Mr. LENNON. We are delighted to have you, gentlemen.

Dr. KAVANAGH. Thank you very much for the opportunity to appear here today to contribute to your hearings on the future commitment of the United States of America in the marine environment.

The report "Our Nation and the Sea" by Dr. Stratton and his colleagues on the Commission on Marine Science, Engineering, and Resources is in our opinion an outstanding document. Based upon the discussions and activity of the marine community in the last decade and especially its own deliberations, the Commission has provided a plan for commitment as well as a focus for further constructive discussion, which you have initiated here.

As a practicing professional engineer, active in planning, design, and management of facilities and structures in the region of the coastal zone and Continental Shelf, I represent one among many engineering disciplines and modes of practice which make up the engineering profession and are represented in the membership of the National Academy of Engineering and its Committee on Ocean Engineering.

As Chairman of the Committee on Ocean Engineering (NAECOE), I am pleased to have this opportunity to relate the interest and activity of the National Academy of Engineering to the national concern for the oceans. This is particularly important since the national activities in the oceans involve all aspects of engineering.

You have been provided with the names of the engineers who are on NAECOE and its panels. The National Academy of Engineering Committee was established at the request of the U.S. Government to provide advice on policy, programs, and organization for effective utilization of oceanographic knowledge for the public welfare and defense. Since 1966, our committee and panels with 60 members have been active as engineering advisor to the Departments of Army, Commerce, Interior, Navy, State, Transportation, and the National Science Foundation, the National Marine Council, and during its tenure, the Marine Commission.

Mr. LENNON. Dr. Kavanagh, excuse me for interrupting your statement, but I feel this membership list of the Committee on Ocean Engineering and also the members of the various panels should appear at this point in the record.

(The information follows:)

COMMITTEE ON OCEAN ENGINEERING OF THE NATIONAL ACADEMY OF ENGINEERING

COMMITTEE MEMBERS

Thomas C. Kavanagh (Chairman)—Praeger-Kavanagh-Waterbury.
Walter C. Bachman—Gibbs & Cox.
Leo L. Beranek—Bolt, Beranek & Newman, Inc.
Ray H. Boundy—Dow Chemical.
Antoine M. Gaudin—Massachusetts Institute of Technology.
Le Van Griffis—Southern Methodist University.
James M. Hait—FMC Corp.
Edward H. Heinemann—General Dynamics Corp.
Alfred A. H. Keil—Massachusetts Institute of Technology.
John R. Kiely—Bechtel Corp.
Edwin A. Link—Ocean Systems, Inc.
Arthur E. Maxwell—Woods Hole Oceanographic Institution.
George C. Nickum—W. C. Nickum & Sons.
Erman A. Pearson—University of California.
William E. Shoupp—Westinghouse Electric Corp.
Elmer P. Wheaton—Lockheed Missiles & Space Co.
Russell Keim (Executive Secretary).

Panel on Commerce and Transportation

W. C. Bachman, A. H. Keil, D. D. MacMillan, F. L. Weldon.

Panel on Construction and Civil Works

J. R. Kiely, A. Casagrande, R. N. Crews, T. C. Kavanagh, L. D. Wilbur.

Panel on Energy and Resources

R. H. Boundy, K. Davis, J. E. McKeen, C. M. Shigley, G. C. Nickum, J. H. Blake, P. G Schmidt, A. M. Gaudin, D. F. Frasche, C. R. Hocott, A. Lubinski.

Panel on Environment Study, Control, and Modification

E. A. Pearson, E. A. Ackerman, M. D. Hollis, H. E. Landsberg.

Panel on Exploration and Surveying

W. E. Shoupp, W. M. Bascom, A. E. Maxwell, W. W. Rand, M. K. Smith, G. E. Solomon.

Panel on Instrumentation, Devices, and Communication

L. L. Beranek, R. O. Briggs, H. E. Edgerton, A. F. Feyling, J. M. Snodgrass, M. L. Vidale.

Panel on Man-in-Sea

E. A. Link, J. H. Clotworthy, J. B. MacInnis, R. F. McAllister, A. Nelkin.

Panel on Research, Education, and Information Dissemination

L. V. Griffis, M. G. Fontana, F. C. Lindvall, N. J. Palladino, R. L. Wiegel, C. R. Wischmeyer.

Panel on Vehicles, Platforms, and Equipment

E P. Wheaton, D. K. Ela, P. Mandel, H. E. Sheets, A. C. Vine, J. G. Wenzel.

Dr. KAVANAGH. The panels of our committee were established to reflect the engineering interests competence, and responsibility in the marine environment. They are: Panel on Commerce and Transportation; Panel on Construction and Civil Works; Panel on Energy and Resources; Panel on Environmental Study, Control, and Modification; Panel on Exploration and Surveying; Panel on Instrumentation, Devices, and Communication; Panel on Man-In-Sea; Panel on Research, Education, and Information Dissemination; and Panel on Vehicles, Platforms, and Equipment.

These panels are broad in scope, I might say, and run from five to 10 members in each panel.

The major thrust of my testimony here today concerns primary program recommendations and comments on organization. Before I present our committee's views, as background I should like to review the function of the engineering profession in both the nongovernmental and the governmental sectors.

Engineering in its modern and broadest sense is the application of knowledge for the use and benefit of mankind. In this context, engineers are concerned not only with the broad technological applications of science, but with their economical, social, and political interaction with man, who thus becomes a critical part of our total systems thinking.

Ocean engineering is that portion of engineering which is concerned with the marine environment, and as in all engineering, spans all modes of professional practice from planning, development, design, construction, manufacturing, operations, and management to research and teaching.

Within the evolving national marine policy, scientific oceanographic research has received an increasing and intense interest and support from the Government, resulting in the availability of a large base of scientific oceanographic information. With the recent increase in economic opportunities and activities in marine resource development for the nongovernmental sector, and with the increased national security requirements for the governmental sector, governmental emphasis is focusing on utilization of the ocean as a national concern. The Marine Commission report itself is responsive to and supports this trend.

While it is well known that the engineering support of scientific research projects is a necessity, the major activity of the engineering profession with respect to the ocean is in the effective use of our marine resources.

As the national interest in the marine environment focuses on resource utilization it is a basic requirement for effective engineering that the scientific information base continue to grow. Therefore the oceanographic research of the scientific profession should not be neglected but be adequately supported as a national investment.

Engineering effort in resource utilization must be effective within the economic, technical, social, and time restraints imposed. Within these restraints there is always insufficient basic information available to the engineers. With these realistic restraints imposed on both the governmental and nongovernmental sectors it is as wasteful of our resources to attempt to solve a problem prematurely as it is to identify a need too late for satisfactory response. Demonstration projects, some examples of which are mentioned in the Commission report as national projects, are appropriate devices, in my opinion, for long-range engineering development—a requirement for timely and optimum problem solution.

As the national interest in marine affairs increases in the governmental-industrial-institutional complex, the procedure by which the Government and nongovernment sectors communicate to obtain engineering assistance for their marine programs will be of increasing importance.

With my personal comments as background, and with the agreement of the chairman, I wish to read the letter forwarded by the Committee on Ocean Engineering to the subcommittee:

NATIONAL ACADEMY OF ENGINEERING,
COMMITTEE ON OCEAN ENGINEERING,
Washington, D.C., May 9, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography,
House of Representatives, Washington, D.C.

DEAR MR. LENNON: The Committee on Ocean Engineering (NAECOE) is pleased to respond to your request for comments and recommendations for consideration during the hearings of your Subcommittee on the National interests in the oceans. The report, "Our Nation and the Sea" prepared by the Marine Commission headed by Dr. Stratton is a significant outline for action and a useful reference.

NAECOE POSITION ON NATIONAL COMMITMENT TO THE MARINE ENVIRONMENT

The Committee considers that it is essential that the United States, as national policy, must be committed to the proposition that we be a leading ocean-oriented nation (economically, politically, militarily, and culturally) as an important and necessary complement to the other national interests.

This commitment would by its nature encompass strong participation by both the non-governmental and governmental sectors. With proper leadership, this commitment to the oceans will also appear as an element in most of the decisions in the life of the nation.

In the context of your deliberations on the Commission report, our Committee wishes to outline a few major points required for implemenation of such a national commitment.

THE OCCUPATION OF SEA BY MAN

The Committee recommends that the objective, The Occupation of the Sea by Man, be an element of the national marine policy.

The term is used in the broadest sense to mean the removal of barriers which prevent man's ability to work everywhere in the ocean environment. This objective will support and is compatible with the development of the ocean's resource, the national security, and scientific investigation.

A MAJOR PROGRAM FOR INITIATION BY THE U.S. GOVERNMENT

NAECOE recommends that initiation of expanded and continuing long-term ocean exploration is a specific program in which the government should take the lead in support of a national commitment to the ocean.

The information from ocean exploration is an essential requirement common to all engineering interest in the marine environment. A program of ocean exploration, by the nature of its long term economic return, is a venture which is best funded primarily by public capital. Detailed exploration programs by the non-governmental sector will complement the governmental program. The private capital invested will increase if, as in all activities where there is joint participation with public and private capital, a consistent and long-term program commitment by the government provides an environment for effective private planning and participation.

INTERNATIONAL COOPERATION IN OCEAN EXPLORATION

There is a significant amount of engineering-related ocean exploration, as well as exploration technique development, that can be accomplished suitably and beneficially by international cooperation.

This position was agreed upon by our Committee after appraising the Proposed International Decade of Ocean Exploration as an element in an expanded program of ocean exploration. As in the national ocean exploration program the Committee calls attention to the necessity to identify the extent to which the engineering-related exploration effort can be included in the program without jeopardizing the legitimate proprietary interests of industry and individual nations.

A NAECOE RECOMMENDATION ON GOVERNMENT OCEAN ENGINEERING CAPABILITY

NAECOE recommends that any organization considered by the U.S. Government for its marine program should ensure that adequate long-range engineering development effort for its program be provided with budgetary priority, allocation, and stability, without separating the effort professionally from the interests of the mission-related marine activities.

We suggest that a governmental entity, if organized to satisfy these budgetary and professional requirements, should have the following functions:

1. Support and coordinate the long-range engineering research and development required for implementing the U.S. Government's current and future functions and missions in the marine environment.
2. Collect, generalize, and disseminate scientific research and engineering research and development data and information concerned with the ocean.
3. Avoid unintentional duplication of engineering development within U.S. Government agencies.
4. Provide a forum to coordinate, as appropriate, the research, the long-range engineering development, and the short-range engineering development among the U.S. Government, the private sector, and state governments.

Policy guidance for such a governmental entity could reside in a group consisting of representatives of the line agencies, which have vital requirements for research and long-range engineering development and have responsibility for implementing the U.S. Government's functions and missions in the marine environment; and representatives of the nongovernmental sector, involved in the development and use of marine resources.

The Committee and its Panels have been concerned with the appropriate development of ocean-related engineering capability in-breadth and in-depth among and within the U.S. Government agencies. A corollary concern is with adequate communication between the governmental and nongovernmental engineering effort especially in ocean engineering research and development.

Without intending to overemphasize the role of engineering research and development or to neglect the major role of other aspects of engineering in achieving completion of a program, we have concluded that in the government marine effort there is a critical weakness in the funding and organization for long range engineering development. Within the government we have particularly observed that mission-related projects for which adequate advanced engineering development is not available, are involved in continual budget problems and costly changes in scope and content. If advanced and generalized engineering effort is included within the scope of the projects, this effort becomes the primary casualty when funding levels fluctuate.

Criteria for differentiating between long range and short range engineering development include: magnitude of the effect on current projects, security and proprietary requirements, and degree of multiagency or multipurpose interest.

Our concern has focused on the critical area of organization for engineering research and development for the government marine program. We will, of course, be available to discuss other aspects of the ocean engineering function within the government at your convenience.

CONCLUSION

We will be pleased to discuss other specific subjects in marine affairs as you continue your deliberations.

Sincerely yours,

THOMAS C. KAVANAGH, *Chairman.*

Dr. KAVANAGH. If I may conclude my remarks then, please be assured that, in discussing only some principal issues and recommendations, I am not unaware of some of the outstanding efforts by the Government agencies to establish and implement effective marine programs.

As you proceed with your discussions, the chairman of the panels of our committee and I will be pleased to appear before you and to assist your staff.

Thank you.

Mr. LENNON. Thank you, Dr. Kavanagh.

Mr. SCHADEBERG. Mr. Chairman, I have no questions, but I would like to thank Dr. Kavanagh for bringing us this information. I realize that you have to study this before you can talk intelligently about it.

Mr. LENNON. Thank you.

The gentleman from North Carolina.

Mr. JONES. I have no questions except to commend the gentleman for his appearance here and for a very fine statement.

Dr. KAVANAGH. Thank you very much.

Mr. LENNON. Thank you, sir.

The gentleman from Alaska, Mr. Pollock.

Mr. POLLOCK. Thank you, Mr. Chairman. I would like to apologize to the chairman and to Dr. Kavanagh for being delayed. I appreciate your being here, sir. I have no questions. I am sure your contribution along with others is going to be of very valuable assistance.

Dr. KAVANAGH. Thank you.

Mr. LENNON. The gentleman from Michigan, Mr. Ruppe.

Mr. RUPPE. Thank you very much, and thank you, Dr. Kavanagh, for a very fine statement.

Basically is your group enthusiastic about your role in oceanography and ocean engineering? Do they see a very substantial potential for positive results?

Dr. KAVANAGH. Yes, our group has been working, as I indicated, for at least 2 or 3 years. We have gone intensively into this matter and we are issuing a report shortly which will look at the whole national program in the oceans from an engineering point of view which, as you realize, is an extremely important point of view.

We are entirely enthusiastic about the possibilities and potentials of engineering to contribute to this program.

Mr. RUPPE. Would you be able to indicate to us what areas of ocean development and study seem to be of the greatest potential, have the greatest potentials for realization at this time? What areas of interest do you see to be paramount in any list of priorities that you perhaps may wish to develop or wish to see your organization develop?

Dr. KAVANAGH. We have not attempted specific priority lists in themselves.

Obviously we look at this from a general viewpoint basically as the National Academy of Engineering functions as a disinterested party, but we do see certain areas.

For example, one of the areas that we see is the concern for the coastal environment, the coastal zone problem. This is a very important areas and it is an immediate area. It is one which needs focusing upon at this time.

In the deeper ocean problem we have generally agreed that our focus should be on the areas of depths to, say, 2,000 feet for the immediate future, but we should work toward a goal of programs which relate to a long-range program of attaining 20,000 feet.

These are the types of priorities and programs which we think are important immediately and which would answer your question, I believe.

Mr. RUPPE. So your organization is prepared to deal with the priorities in a very specific manner as national interest is directed in that area?

Dr. KAVANAGH. Yes, we would.

Mr. Pollock. Would you yield?

Mr. Ruppe. I yield.

Mr. Pollock. Dr. Kavanagh, I notice in the beginning of your statement on the first page right at the bottom line that you talked in terms of planning, design, and management of facilities and structures in the region of the coastal zone on the continental shelf.

Did you mean your term "the coastal zone" to include the 3-mile and contiguous zones?

Dr. Kavanagh. My own professional practice is as a civil engineer and my practice brings me into all of the deeper portions of the coastal zone in connection with beach erosion problems, deep foundations, deep tanker facilities, berthing facilities and maritime work of this type, structures in the coastal area.

We call this in our field, coastal engineering. This happens to be one of the areas of my particular practice.

Mr. Pollock. From our point of view we think of coastal zone as the 3-mile area and then we have the contiguous 9-mile zone and then the Continental Shelf. Of course, all of this could be part of the Continental Shelf. I just wondered if you meant to exclude the contiguous zone.

Dr. Kavanagh. Not at all. As a matter of fact, we have made studies in my particular private office. For instance, one of the focal projects mentioned by the commission is a project concerned with floating stable platforms.

The idea of a stable floating platform is an extremely important one which, technologically speaking, we have the answer for right now. Therefore, as to the Commission specifying this particular project as a focal project or as a national project in which some study ought to be made, the technology is really there.

We have in our office, for example, the people who were involved in the design of the breakwaters, towed across the channel during the Normandy Beachhead invasion. We have bridges standing upon floating structures. We have piers, very large piers, in New York, standing on floating structures, but the concept can be expanded with our existing technology to include even things like nuclear plants, floating not just within 3 miles but offshore as far as you like.

The technology of this is there and certainly we do work in this area regardless of limits of 3 miles or contiguous zone.

This is just an example of my own practice where we are capable of doing these things, and I point out that in this case technology is available to do this and it doesn't require fundamental research or development. It requires a project.

Engineers don't operate in a vacuum. They operate on a project. The idea of demonstration projects, or as they are sometimes called, prototype or focal projects, is a very good one to approach any engineering problem.

Mr. Pollock. In my country of Alaska in Cook Inlet where there are a number of platforms for drilling oil, we have the second highest tides in the world. We have quite a flow of tide. Your statement is rather intriguing. I don't know how your floating stable platforms would work against very high tides.

Dr. Kavanagh. I personally made a study of an airport off the city of New York.

Mr. POLLOCK. Airport?

Dr. KAVANAGH. An airport, a floating airport, and I find that with the technology as it exists at the present time, without doing any further research and development, such an airport would be feasible, of the size of Kennedy International. We haven't published this information, but it is a type of project which can be done even with our present knowledge. It is a feasible project.

Imagine the importance of a thing like this. It does not involve noise problems and so on by pulling it offshore, pulling it off on Long Island Sound or anywhere else you like. This has great potential. It is only one little tiny element in this total problem of engineering of the oceans, but it happens to be one in which I am personally interested.

Mr. POLLOCK. The more you say, the more intriguing it gets.

Several months ago I tried to land on Alaska's Little Diomede Island which is right off Russia. I had to cancel my plans because half of the ice field where the planes landed floated away. There was no place to land.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you.

Has the gentleman from Michigan concluded?

Mr. RUPPE. I have. Thank you for a most interesting presentation.

Dr. KAVANAGH. Our committee has been asked to come to Alaska and confer with the people there on ocean engineering matters.

Mr. RUPPE. Are you referring to his country of Alaska? I thought maybe they had been offered a better deal for their oil.

Mr. POLLOCK. No comment.

Mr. LENNON. The gentleman from Virginia.

Mr. DOWNING. I have no questions. I regret not being here for the entire presentation. We worked on a $4 billion space budget this morning.

Mr. LENNON. The gentleman from California, Mr. Leggett.

Mr. LEGGETT. Thank you very much, Mr. Chairman.

I am sorry that I didn't hear your oral presentation, Doctor, but I have read through some of your remarks and I take it you fully support the recommendations of Dr. Stratton and the Commission.

Do you have any recommendations with respect to the emphasis to be placed on the work of the agency to be developed by the Commission?

Dr. KAVANAGH. I did in the written statement from our committee try to emphasize one area of deep concern to our committee, and that is the area of long-range engineering development. This areas, as I indicated, is improperly handled at the present time. It is subject to budgetary fluctuations and as a result the whole ocean program suffers.

We have suggested that any organization, regardless of what reorganization is done in the Government, should consider adequate engineering development in support of Government functions in the marine environment. This requires coordinated effort by all agencies in long-range development, especially. On this subject we have tried to give our reasoning as to what should be the functioning of any reorganization.

I think this is the best answer I can give you as to specific detail which I would like to go into at this time.

Mr. LEGGETT. Let me ask you this. How do you do that when we have a large underwater function with the Navy Department and are not merging that with this Department? Do you see any conflict there, or duplication?

One question that naturally arises with me is that I was working last week on a proposal with the Navy Department for a sea stable platform and you are talking about it too. It seems to me that they have most of the dollars in the Department of Defense and they are going to continue to be doing a tremendous amount of underwater research. If this agency is to be the primary oceanographic exploratory and engineering agency, I think we have problems of getting the proper allocation of Government dollars.

Dr. KAVANAGH. Well, as I stated, in any large-scale and long-range engineering development project we feel it is important that all line, ocean-related agencies, and this would include the Navy, would have an active interest in these long-range programs. They are of multipurpose, multiagency interest. Of course, there are shorter-range projects that must be directly in support of agency functions, whether military or civilian. I don't see any conflict in this.

If some are defense oriented and are of confidential nature, the problem is still the problem of floating a platform. This is a technological problem and the development effort is equally applicable to the Navy requirements or any defense agencies' requirements as they are to civilian use. In the committee's letter to the subcommittee chairman, some criteria for differentiating between long- and short-range engineering development were outlined.

I point out that we are not specifically endorsing NOAA. We have not prepared comments on the organizational detail of the Commission report. We have tried to supplement the Commission's generally excellent arguments for organizational functional requirements. I think the Commission's presentations are fully in accordance with the aims of the Marine Resources and Engineering Development Act of 1966. They do provide a mechanism, but I say regardless of what mechanism is used, the point that we think is very important is engineering development, long range particularly, which suffers under the present system.

Mr. LEGGETT. Let me ask you this: Do you think the inclusion of the Weather Bureau in the proposed agency is helpful or confounding for the mission that you envision in primary engineering underwater exploratory work?

Dr. KAVANAGH. I can't answer this specifically. I can say that in my book oceanography is so closely related to atmospheric systems that somewhere the atmosphere and the oceans have to get together.

To this extent, whether it is a weather bureau on land or not, this is beyond my scope of interest and activity.

Mr. LEGGETT. It just seems to me that 90 percent of our weather reconnaissance activity is over land. We are very concerned about what is over the sea, but we have just very few facilities to get that kind of information. I think that is all the questions I have, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Leggett.

Doctor, I note that you state that the committee on Ocean Engineering of which you are chairman is a part, of course, of the National Academy of Engineering and that there are some 60 members of the National Academy of Engineering Committee on Ocean Engineering and back in 1966 at the request of the Federal Government, NAECOE, meaning you as chairman and the other 50 or 60 members of your group, were organized.

Just for the record, how was that done? From whom did that request come at the Federal level for the National Academy of Engineering to organize a Committee on Ocean Engineering?

Dr. KAVANAGH. The National Academy of Engineering is a sister organization to the famous National Academy of Sciences. It was established in December of 1964 as a professionally autonomous academy under the same charter which created the National Academy of Sciences in 1863. In 1965 the Navy, Interior, Commerce, and National Science Foundation forwarded requests to the President of the National Academy of Engineering for continuing advice in ocean engineering. These requests were sent with the concurrence of the Interagency Committee on Oceanography, which represented basically all of the agencies of the Government interested in the oceans.

Mr. LENNON. You say, "Since 1966, our Committee and Panels with 60 members have been active as an engineering advisor to the Departments of Army * * *."

Is that in the field of the Corps of Engineers or is that general?

Dr. KAVANAGH. In the Army it has been primarily with the Corps of Engineers; yes. We have had many interim projects with them.

Mr. LENNON. That is on a consulting fee basis?

Dr. KAVANAGH. No, sir. The members of the Academy committees and panels receive no consulting fees. The Government provides funds for travel, per diem, and professional and clerical support.

Mr. LENNON. These are not compensated for. These are contributions to the Federal Government through the National Academy of Engineering?

Dr. KAVANAGH. That is right.

Mr. LENNON. In relation to the Department of Commerce, you have also been engineering adviser to them as the Committee on Ocean Engineering. In what agencies of the Department of Commerce has your engineering advisory group on ocean engineering been related to the Department of Commerce?

Dr. KAVANAGH. We have been adviser to ESSA, among others.

Mr. LENNON. I am trying to build a record here.

Dr. KAVANAGH. I can tell you just offhand some of the problems. For example, most recently we have a joint steering committee with the National Academy of Sciences' Committee on Oceanography and the National Academy of Engineering Committee on Ocean Engineering. This joint steering committee has studied in great detail the proposal for an "International Decade of Ocean Exploration."

Our report is prepared and it shortly will be released, within the next couple of weeks.

Mr. LENNON. The Environmental Science Services Administration or ESSA, which is in the Department of Commerce, have you been adviser to that group? They are interested in oceanography in many aspects.

Dr. KAVANAGH. Yes; we have been adviser to them. We have advised the Navy in studying their programs, a great many programs of this type. We have been with the Corps of Engineers on their coastal programs. These are the types of things.

Mr. LENNON. How about relating your relationship to the Department of the Interior in an advisory capacity related to oceanography.

Dr. KAVANAGH. The Bureau of Commercial Fisheries and the Bureau of Mines. We have been operating with them because these are areas in which our panels are extremely active. That is the mineral resources of the ocean, and the living resources. The Federal Water Pollution Control Administration (FWPCA), we are doing a current study for.

Mr. LENNON. I note that on page 1 in your comments that you refer to the report of the Commission on Marine Science, Engineering, and Resources, "Our Nation and the Sea," chaired by Dr. Stratton, as an outstanding document.

Then you subsequently refer to their objectives. You did not comment when the question was raised by the gentlemen from California, Mr. Leggett, as to what is the position of your committee with respect to the specific recommendations made by the so-called Stratton report.

No. 1, what is your feeling about the establishment by legislative act of NACO, the National Advisory Committee of the Oceans? What is your reaction to that, Doctor?

Dr. KAVANAGH. We have not taken a position on this specifically, Mr. Chairman. However, certainly we endorse the idea that some agency and advisory reorganization in the Government is necessary at this time. It would be folly perhaps——

Mr. LENNON. NACO is, of course, not a Government structure, as you know. It is an advisory commission, to be appointed by the President, of 15 individuals, confirmed by the Senate, outside of the sphere of Government, from the private sector primarily. Some of our witnesses have indicated that in their judgment that should be the first priority for the consideration of this committee.

Has your group, since you have been involved in the advisory capacity on oceanography for some six of the Federal agencies, taken a position with respect to the fact that this is the right approach? Since you have been intimately involved in advising a number of our Government agencies in oceanography has your group taken any position with respect to the projected recommendations of Dr. Stratton's commission?

Dr. KAVANAGH. Our group has not taken such a position, sir.

Mr. LENNON. Who would be in a better position to take a position, Doctor, since you have been inexorably involved in an advisory capacity to some seven of our Government agencies from the State Department on down? Why isn't your oganization in a position to make a study in depth of this report and give the benefit to this committee of your deliberations and judgments?

I am just trying to get something for the record. Where do you stand?

Dr. KAVANAGH. I would be pleased to take this up with the committee, sir, and suggest this as a course of action.

Mr. LENNON. The report has been out since January. I know it has been available to you since January and also to the other members of your committee.

Go ahead, sir, and answer my own question. Do you want to comment on that statement?

Dr. KAVANAGH. No. I am merely stating that the National Academy of Engineering does not take positions generally on governmental organization. This we felt was beyond the scope of our assignment. We were advising technically and programwise but not specifically on the details of governmental organization.

Mr. LENNON. I take it then that you wouldn't have any comments with respect to recommending a governmental structure of NOAA. You have no position on that. It just seemed to me that, since you had been in the position of engineering adviser in the field of oceanography to the State Department, to the Navy, to the Department of the Interior, to Commerce, and all of these other federal agencies, that hopefully you would be in a position to make some definitive statement with respect to this report.

I find that I am a little bit disappointed that you have not. If this committee cannot get the judgments of those people who are in a position to make a judgment as professionals in this field, it is going to be difficult to get it from laymen regardless of their association with the Federal Government. I don't mean to belabor the point, but I am hoping that there are members of your panels, Doctor, who could at some future date come to the committee and give us these specific recommendations because ultimately a decision is going to have to be made by the Members of Congress, and we are just simple laymen and have to rely on those of you who have the expertise in the field and especially those of you who for more than two and a half years have been giving advice to all the departments and agencies of the Federal Government related to the field that we are talking about.

The gentleman from California, Mr. Hanna.

Mr. HANNA. Thank you, Mr. Chairman. I want to apologize for not being here at the presentation of your testimony but I have been able to read it since I have come into the room. I would like to take the opportunity in the presence of the gentleman, Mr. Chairman, to make a couple of points that I have had in my mind to try on several witnesses.

First of all, it has been evident to me that there is a great deal of problem for the Congress, particularly this committee, on this subject matter to get the appropriate inputs from the scientific community for the reason that there is a longstanding history of some conflict between the various branches of science as to their appraisal of their own standing in a particular field and their appraisal of perhaps contending sciences in the same field, and then I have noted a not inconsequential kind of conflict between those who indulge in pure scientific study and those who are in what we call the applied science, and then a third conflict between those who are in the engineering aspects of science and those who are in the categories such as biology and so on.

Now, I would like to have your comments on the potential for resolving some of this conflict because I can see from your answers to the chairman that you people abhor politics, but may I suggest you have a political problem in your own body in resolving and coming

up with some kind of a consensus from which we can operate and from which we can evolve an appropriate national policy and without you solving that political problem, you are going to be leaving us to make decisions in somewhat of a vacuum created by your own inabilities to arrive at a consensus.

So would you enlighten us with your comments.

Dr. KAVANAGH. First, I would like to comment that in the exercise on the proposed International Decade of Ocean Exploration which we engineers have gone through in the last 6 months or so wherein we worked very closely with the scientific community—and by this I include the people whom you call pure scientists who may be applied scientists—was a tremendous success and there is no such conflict existent if the parties involved understand that engineers need scientists as much as scientists need engineers. We work hand in glove together.

These are the basic things. They provide the knowledge. We apply this knowledge. We, I say, as engineers apply this knowledge for the benefit of mankind. There is no conflict of this type. I don't think that it really exists or should exist.

Mr. HANNA. May I suggest that what appears to me to happen is that when you get them into a specific exercise in which there is a mix of the pure scientists and the applied scientists and the long-range engineer and the practical engineer, this works well in a specific, but as soon as they part company, they go into an abstract world and when we ask for their comments, they get it from the abstract rather than the real world, and I am suggesting to you that that isn't very helpful and is there some possibility that we can get them to operate for us on this more practical plane in which, as you have indicated, they have demonstrated that there is no real conflict except that, for maybe historical as well as hysterical reasons, they tend to conflict.

Dr. KAVANAGH. I can only comment that perhaps in my own view you are asking the wrong person for the right answer. If you ask an engineer, I think he is accustomed to answering the questions which I gather you want answered, what use is this to me or what can I do with this. If you ask a theorist about this, naturally he is not as much close to the problem as we are in engineering. But I am not saying that one or the other can be dispensed with in any way at all. They are both part of the total system.

This system starts at the beginning with knowledge, and it ends with man, and the fruitfulness of his use of the resources of the earth. This is the total picture, the systems view of the whole project.

I must apologize to you that I have not a position statement with respect to NOAA simply because I interpreted our particular Academy of Engineering, Ocean Engineering Committee, as in an engineering sense we would provide you with the engineering data and the alternatives and the possibilities necessary for a solution, for a decision process, but the decision process is not ours.

We can evaluate this as best we can in our mind and present these to you, but we have not studied the problem in its complete implications, which would include some political aspects in this particular case.

Mr. LENNON. Will the gentleman yield at that point?

Mr. HANNA. Yes.

Mr. LENNON. I guess the reason I got into this was your statement on page 3, and I quote:

> Engineering in its modern and broadest sense is the application of knowledge for the use and benefit of mankind. In this context, engineers are concerned not only with the broad technological application of science, but with their economical, social, and political interaction with man, who thus becomes part of our total systems thinking. Ocean engineering is that portion of engineering concerned with the marine environment, and as in all engineering, spans all modes of professional practice from planning, development, design, construction, manufacturing, operations, and management to research and teaching.

That is the reason, doctor, that I thought you had moved out as you indicated that engineers are not just concerned with the broad technical application of science but that you had the economic, social, and political interaction that you said you had in your statement.

That is why I inquired into your basic thinking with respect to how your group, since you had had this rapport with so many of our agencies from the State Department on down, reacted to some of the specific recommendations made in this so-called Stratton report.

I yield back to the gentleman from California.

Mr. HANNA. There was only one other point that I wanted to make with the witness, Mr. Chairman.

That is that I have personally entertained the concept that, in addition to and supplemental to any new configuration of depth for the activities of the ocean, we ought to define and embark on mission-oriented activity. It is my belief that this would develop not only a new generation of information, but also a very salutary intermix of all these things that you and I have just been discussing. This would help us evolve a better frame in the Government for handling this very important aspect of environment.

What is your reaction to that? In other words, I am an old Lewis and Clark man. I like to get somebody in a group and get out there doing some things that feed us back from a practical level of living with the activities, how you are going to control it and the best manner in which to make it interact. What is your reaction?

Dr. KAVANAGH. Well, I think I have indicated to you that there is an important need, and I think the Commission has recognized the need for more technology in the oceans, and here I say we are talking in an engineering sense of the application of the knowledge that we have.

But this doesn't mean that we have all the knowledge available. We need more. This very exploration program that I used as an illustration, this Decade program, is one where we need more exploratory knowledge upon which to base, for example, our mineral recoveries from the sea. We don't have sufficient survey and basic data as to locations of minerals to make this profitable. So, one of the constraints that we face is lack of knowledge or insufficiency.

Mr. HANNA. Apart from that, though, what I am interested in is: Do you agree, or disagree, that, before we start getting too frozen in cement about how we want to configure these things, it would be well to have some activity going on as a prime work of reference as to how this thing is really going to function?

Do you think we should wait until we have set up a new acceptable framework, or should we be moving ahead in terms of mission-oriented activity?

Dr. KAVANAGH. I think we should be moving ahead in the sea far faster than we are moving at the present time. It is my understanding that this is the function, for instance, of the National Marine Council which is to get this action moving, and I think the sooner we act upon it and get more action in the Government, the better off we will be in terms of the oceans.

Mr. HANNA. I thank the gentleman. I yield back the chair.

Mr. LENNON. The gentleman from Ohio.

Mr. FEIGHAN. I have no questions, Mr. Chairman.

Mr. LENNON. Doctor, in reading again the letter that you read into the record that was addressed to the chairman of the subcommittee on May 9, I really interpret the four points that you made with respect to your organization's recommendations that actually you have in the summation of these four points in a way endorsed in substance some of the recommendations of the Commission report.

Is that a fair statement? I am not referring to any so-called National Advisory Committee for the Oceans, but their objective.

Dr. KAVANAGH. I would say yes, that there are many of the things in that report which we endorse wholeheartedly. Yet I can't say as an unqualified statement that this is endorsed in its totality, but we have given you alternatives here, which I think is our important function, pointing out things which may not have been considered in that report, one of which is the alternatives of organization and we pointed out the highlights of that area which we are most concerned with.

Mr. LENNON. This committee took, along with its counterpart in the Senate, approximately 2 years to hammer out a piece of legislation that we finally enacted into law which brought into being this commission. They were mandated to make a study in depth of all of these areas that you have discussed and which your commission represents as well as to recommend if, in their judgment, such was a feasible and logical Government structure. I believe that there is no commission that ever was more dedicated in their efforts to try to find a meaningful program projected in their report to the Congress.

It is a challenge to the committee and to the Congress as to whether or not that report will be implemented in its entirety or even in part. To some degree, to an immeasurable degree it is going to depend on the gentlemen in the executive branch of the Government.

We had the assurance of Dr. Wenk on the National Council established under the act that they had been instructed by the executive branch of the Government to make a study of the report and make their recommendations to the executive, and Dr. Wenk has indicated in a letter to me within the last 4 days that they would be prepared to testify on the report, and I assume that they will at that time reflect the administration's position.

To me it is a little bit unfortunate that some of the people in the administration at the Cabinet level have already taken public issue with the recommendations of the report. I think they ought to at least have waited until the Council had made its study and recommendation to the administration inasmuch as they were requested by the administration to make a study of the report and make a recommendation. I think they were a little premature.

Does counsel have a question?

Mr. DREWRY. Yes, Mr. Chairman.

In the interests of saving time this can be supplied for the record, Dr. Kavanagh, but I believe the record should show something more than your statement does as to what the National Academy of Engineering is, how it came about, what its total composition is.

I don't recall, myself, just how long the National Academy of Engineering has been in existence.

Dr. KAVANAGH. The National Academy of Engineering was formed in December 1964. It was formed under the same charter as the National Academy of Sciences.

The National Academy of Sciences' charter under Lincoln had the statement that the Academy advises the Government in the arts and the sciences. The arts at that time meant engineering, practical arts.

Under this charter we now operate as a sister organization.

(The following information was supplied for insertion at this point in the record:)

NATIONAL ACADEMY OF ENGINEERING

The National Academy of Engineering, a professionally autonomous group, has a present membership of 280 engineers. The National Academy of Engineering was established on December 5, 1964 as an organization of distinguished engineers, parallel to the National Academy of Sciences, autonomous in its administration and in the selection of members, and sharing with the Academy of Sciences the responsibility for advising the federal government.

The Articles of Organization of the National Academy of Engineering adopted by the twenty-five Founding Members set forth the following objectives and purposes:

1. To provide means of assessing the constantly changing needs of the nation and the technical resources that can and should be applied to them, to sponsor programs aimed at meeting these needs, and to encourage such engineering research as may be advisable in the national interest.
2. To explore means for promoting cooperation in engineering in the United States and abroad, with a view to securing concentration on problems significant to society and encouraging research and development aimed at meeting them.
3. To advise the Congress and the executive branch of the government, whenever called upon by any department or agency thereof, on matters of national import pertinent to engineering.
4. To cooperate with the National Academy of Sciences on matters involving both science and engineering.
5. To serve the nation in other respects in connection with significant problems in engineering and technology.
6. To recogize outstanding contributions to the nation by leading engineers.

Mr. DREWRY. And the Committee on Ocean Engineering is a portion of the National Academy of Engineering which contains how many committees?

Dr. KAVANAGH. There are presently half a dozen committees created by the Council of the Academy of Engineering. Others are being actively considered for establishment.

Mr. DREWRY. What I want to know is what other areas of engineering are covered by the National Academy of Engineering?

Dr. KAVANAGH. The National Academy of Engineering covers all areas of engineering: housing, transportation, oceans, materials, space and aeronautics, bioengineering, and so on.

Mr. DREWRY. In other words, the total environmental range of engineering?

Dr. KAVANAGH. Yes, sir; very definitely.

Mr. DREWRY. And then it was decided subsequent to the creation of the National Academy of Engineering that there should be the specific Committee on Ocean Engineering to focus on that part of the total picture?

Dr. KAVANAGH. Yes, and most of the members, at least 50 or 60 percent of the members of our committee and its panels are members of the National Academy of Engineering.

Mr. DREWRY. This question has some background relevance to it because of some earlier testimony we had that, even though the National Academy of Engineering was set up to cover the whole range of environmental engineering, that, nevertheless, there needed to be some special focus on this particular aspect.

Dr. KAVANAGH. Yes.

Mr. DREWRY. I notice you have in panel No. 1 on Commerce and Transportation, under the chairmanship of a very distinguished naval architect, two other naval architects, and Dr. Weldon, who has had much experience in the research and development field now at the Ford Motor Co., and formerly with the Matson Navigation Co. We have been hearing in the last few days about the need for research and development in the shipping field.

Has the panel on Commerce and Transportation provided any inputs or been invited to deal with the engineering problems in relation to shipping and shipbuilding?

Dr. KAVANAGH. Yes, they have had discussions with agencies of the Government in this area, their preliminary panel report has been prepared and has been made available to the agencies recently.

Mr. DREWRY. How often do the various panels meet?

Dr. KAVANAGH. Our panels have met in lifetime perhaps each of them at least 5 times to 10 times. They meet rather frequently and also have met as groups with the governmental agencies.

Mr. DREWRY. What is your relationship with the National Academy of Sciences' Committee on Oceanography?

Dr. KAVANAGH. The National Academy of Sciences, our sister organization of the National Academy of Engineering has a committee of long-standing, the National Academy of Sciences' Committee on Oceanography. They represent basically the scientific interests of the oceans. We represent the engineering interests of the oceans.

I think hand in glove we work together on many, many of our projects, our interim projects of our committee, such as the decade program which was a 50–50 management of this project with 50-percent participation from them and 50 percent from us, and I think this was a very effective example of how cooperation between science and engineering should be done, should be achieved.

Mr. DREWRY. And your headquarters are housed in the same building?

Dr. KAVANAGH. As a matter of fact, they are next to one another.

Mr. DREWRY. And Dr. Keim and Dick Vetter are good friends and talk to each other?

Dr. KAVANAGH. Oh, yes, they are very good friends.

Mr. DREWRY. At this point I have one other thing.

In late January I got a letter with a questionnaire attached which was supposed to have been seent to about a thousand individuals engaged in, or interested in, oceanographic work, and the letter reads:

The first problem encountered by the oceanic pioneer, although not a matter of life and death, is critical in that no matter how qualified or motivated he is, he cannot move his family into the ocean unless he first purchases a suitable home. Because of the nature of the environment in which they function oceanic homes are necessarily more expensive than a comparable land home.

Then the questionnaire goes on:

Why do you want to live on or in the ocean? Where in the ocean do you want to live and why? Do you expect to be employed on the mainland; if so doing what? If so, how would you expect to be employed in the oceanic community? How much do you expect to pay for an oceanic home? What particular features do you want your home to have? Would you prefer a relatively stationary or mobile oceanic home? When do you think you would be ready to move to the ocean: Now, 1 year, 2 years?

Et cetera.

Have we gotten that far yet? This seems to be sort of a—I don't know whether you would call it a real estate proposal or not. I haven't heard any testimony that indicates that we have gotten quite that far despite Tektite and the Sealab program.

Dr. KAVANAGH. I think these are the Sunday supplement oceanographers, sir.

Mr. DREWRY. Thank you, Dr. Kavanagh.

Mr. LENNON. Thank you, Doctor.

I am very happy that you have graciously furnished us with the names of the members of your Committee on Ocean Engineering and also the members of the Panels, because I think, with your permission, sir, we would like to reserve the right to perhaps, as we move on in these hearings, extend an invitation to some of them to come and testify in their particular field of interest and expertise.

Dr. KAVANAGH. Yes. Many of them have already expressed this desire, sir, and stand ready to come.

Mr. LENNON. We would be very grateful if that could be done. We do appreciate it very much.

I wonder if we could go off the record.

(Discussion off the record.)

Mr. LENNON. Dr. Kavanagh, Mr. Paul Rogers, of Florida, has certain questions.

Mr. ROGERS. Thank you, Mr. Chairman.

Dr. Kavanagh, I apologize for being late. I was in another committee where we were writing a bill so that I had to be there.

I have read your testimony. I am not sure I understand. You say we do need reorganization, but I am not sure whether you agree with the Commission's recommendations or not. I apologize for not hearing you perhaps comment earlier. Do you agree with the Commission's recommendation that we need to reorganize the governmental effort?

Dr. KAVANAGH. Yes. I did indicate that we felt reorganization was very definitely necessary. We feel, ourselves, strongly that way. The only thing that I could not say is that we specifically endorse the specific recommendation made by the Marine Commission on a NOAA as it is spelled out. We have not simply discussed this in this detail.

We felt that we were here in an advisory capacity, in a technical advisory capacity. We have tried to point out alternatives which must be

considered in the reorganization, one of the most important of which is to get moving in the field of long-range engineering development which, in the present governmental setup, system, is ineffective. It suffers, and as a result our whole program falls flat on its face.

Mr. ROGERS. So the present setup is not working?

Dr. KAVANAGH. Yes.

Mr. ROGERS. And we need the reorganization. This is your testimony, although you are not giving us the specifics as to what an organization should be?

Dr. KAVANAGH. Yes.

Mr. ROGERS. But you agree in principle that we need to have a new approach and new organizational setup?

Dr. KAVANAGH. Yes, but in essence I also indicated that since engineers do get involved in politics, we would be happy to look at this problem from that viewpoint because engineering does involve all aspects of man's activities, including social problems, economic problems, and political problems as well.

We simply have not felt that it was within our jurisdiction to comment on the detail of organization in our studies. We concentrated on functional requirements.

Mr. ROGERS. I understand. I think it would be helpful.

Dr. KAVANAGH. Our Panel people will be happy to be available and in fact would welcome the opportunity to testify in any respect in this connection.

Mr. ROGERS. Thank you.

Mr. LENNON. Thank you, Doctor.

Mr. Drewry?

Mr. DREWRY. Dr. Kavanagh, this is sort of a leading question. Hasn't it long been—or all the way back to the time when Lincoln set up the National Academy of Sciences—pretty much the policy of the National Academies that, being made up of citizens who are making contributions to aid the Government, that your policy has been that you stay away from areas which are of a governmental policy or political policy level and that you don't feel that it is appropriate in your position as an Academy to go into the point of recommendations with respect to how such things should be done?

Dr. KAVANAGH. Yes. Fundamentally I thought I stated this to the chairman, but I am not sure whether I stated it as well as you did.

The National Academy, any national academy is an independent, unbiased organization, and therefore it does not go in and sell any particular problem to Congress or to the Government. We can furnish advice on policy matters.

Mr. DREWRY. When we go into looking over this list which already contains names which we intend to invite or who have asked to be heard, then they will be appearing as individuals and can say whatever they feel?

Dr. KAVANAGH. Absolutely.

Mr. ROGERS. Will the gentleman yield?

I presume if we asked you for advice on this, there would be nothing to prevent it?

Dr. KAVANAGH. As an individual, yes.

Mr. ROGERS. What about as a group? Suppose we ask you?

Dr. KAVANAGH. I can only say that we are subject to the Council of the Academy when we come out as an Academy Committee to state the position of the Academy.

Mr. ROGERS. What I think is that, if Congress asks specifically, this committee, your advice as to organization, I presume with the expertise that you have assembled there, you would be willing to give it to Congress.

Dr. KAVANAGH. Yes. I indicated that I would be willing to go back and try this tack.

Mr. ROGERS. I wanted it made clear for the record that we want your advice.

Dr. KAVANAGH. Yes.

Mr. LENNON. Thank you, Mr. Counsel and Mr. Rogers, for getting the record straight.

Dr. KAVANAGH. Thank you for the opportunity to be here.

Mr. LENNON. The program for tomorrow calls for a presentation of the recently completed Tektite project—a most interesting and imaginative program—involving, and I think this is important, the cooperation of industry and Government agencies in underwater habitat experimentation.

Presentation will be made by representatives of the Navy, the Department of the Interior, the National Aeronautics and Space Administration, and the General Electric Co.

The four aquanauts will be present. They are Mr. Richard A. Waller, oceanographer; Mr. Conrad V. W. Mahnken, oceanographer; Dr. H. Edward Clifton, geologist; and Mr. John G. Van Derwalker, fishery biologist.

All of these gentlemen are of the Department of the Interior. We think it will be a very imaginative, interesting and challenging program.

We will recess to reconvene tomorrow morning at 10 o'clock for this purpose.

(Whereupon, at 12:10 p.m., the subcommittee recessed, to reconvene at 10 a.m., Thursday, May 15, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

THURSDAY, MAY 15, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:15 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. Ladies and gentlemen, the meeting will please come to order.

You all know that we have been conducting a series of hearings on the Marine Science Commission Report, entitled "Our Nation and the Sea"—and some may wonder why we have invited these gentlemen here today to tell us about Project Tektite.

This past November I visited the site of this project, and I thought at the time if the four aquanauts were able to accomplish their 60-day stay in the underwater habitat, this subcommittee should recognize their exploit by asking them to come and tell this committee of their accomplishments.

Since that time, I have had an opportunity to look further into this project and to learn that this was a cooperative effort on the part of several Federal agencies and private industry. Of course, we now know that the vice president, in ceremonies at the White House yesterday, presented each aquanaut the Distinguished Service Award. Unfortunately, subcommittee assignments prevented my attending.

As the members of the subcommittee know, the basic theme of the commission report is one of cooperation among all sectors in the marine sciences, to form a truly dynamic national marine science effort.

I believe the other gentlemen here share my enthusiasm for the accomplishments of Project Tektite, and you can understand why I invited the full committee, and Mr. Teague's Science and Astronautics Subcommittee on Manned Space Flight.

I might call to the attention of our distinguished visitors that this morning the Space Committee is marking up their annual authorization bill. We have a number of members of this subcommittee who are also members of that committee, and after they complete the action on that bill we expect them here.

Our colleagues, Representatives Teague, Giaimo, and Shipley, all visited the Tektite project site during the operation. We expect those gentlemen shortly.

I would like to comment, too, on a news release by the Secretary of the Interior of May 14, yesterday. I am only going to quote one paragraph. I quote:

> I believe the Tektite Program proves that there is determination and imagination and new ideas if we can pull away the curtain that has prevented man from learning about the tremendous resources that lie beneath the surface of our oceans.

To begin this hearing, I would like to recognize the Hon. Russell E. Train, Under Secretary of the Department of the Interior, who will introduce the coordinator of today's program, and those participating in it at this time and, since he is here ready to make that presentation, sir, you may proceed, Mr. Secretary.

We are delighted to have you here and also to have so many other distinguished guests.

STATEMENT OF HON. RUSSELL E. TRAIN, UNDER SECRETARY OF THE INTERIOR

Mr. TRAIN. Good morning, Mr. Chairman, and Mr. Pelly, and other members.

Would you like me to proceed with a statement at this time or introduce Admiral Waters?

Mr. LENNON. Perhaps you could give us your statement, if you will, and I have the names of the other gentlemen who I assume will present their respective views.

Mr. TRAIN. All right, sir.

Mr. Chairman and members of the committee: We are pleased to have the opportunity to appear before you today to describe what is certainly one of the most exciting recent events to take place in the ocean—Operation Tektite.

Interior is proud to have been a partner in this very successful undertaking, and we are proud, too, of our four aquanauts who performed so magnificently. As you have been informed, three of the aquanauts, Richard Waller, Conrad Mahnken, and John Van Derwalker, are with the Bureau of Commercial Fisheries; the fourth, Dr. Edward Clifton, is with the Geological Survey. These four scientists, with their different interests in biological and geological oceanography, made a well-balanced team.

I would also like to mention the backup or standby aquanauts who were always ready to step in—or perhaps we should say dive in—if one of the principal aquanauts got into trouble. These were: Gary Davis, of the National Park Service; Larry Phillips, of the Geological Survey; and Ian Koblick, of the College of the Virgin Islands. A team of Navy divers also was on hand, and we were grateful for their presence.

The contributions of the National Park Service, which provided the site in the Virgin Islands National Park and numerous other services and courtesies, should not be overlooked. We would also like to extend our thanks to the College of the Virgin Islands who gave superlative support in addition to supplying one of the backup aquanauts.

Each of the participating organizations had its own objectives and reasons for taking part in Tektite. Interior, as you know, has very broad interests in the ocean and its resources, including its purely physical processes, its geological structure and mineral content, its

importance as a source of human food, as a means of recreation and as a source of fresh water.

We in Interior are always interested in exploring new ways to study the ocean. One cannot gain a complete picture of what is going on below the surface of the sea if he must make his observations from the shore or from the deck of a ship. It is necessary, we believe, in certain studies at least, for man to go below the surface and become a part of this underwater environment if he is to understand the very complex processes and interactions that occur there. Fixed habitats like Tektite, and submersibles that can move, both have an important role to play.

Interior is also interested, of course, in studying the ocean with remote sensing instruments from spacecraft, buoys, and other unmanned vehicles.

The Tektite experiment gave us the opportunity to evaluate saturation diving and the underwater habitat as a new research method and tool, and to develop a cadre of men trained in this new field. They will now return to their laboratories and pass on these new skills to others in our field research programs. Tektite has been a very profitable experience to Interior and we look forward to other experiments of this kind.

As Secretary Hickel said at the award ceremony yesterday:

> I think their accomplishment is ample proof that Interior is serious about developing the resources of the ocean—that this is not a conservative, old line department which has no interest in new ideas and techniques, as some people have said in the past.

I can't help but comment, Mr. Chairman, that I returned last night from the north slope of Alaska, having spent the night before at Point Barrow inquiring into the problems of the Arctic environment in which Interior has a very strong interest, and here again I think is an example of the breadth of our interest.

One of the aquanauts mentioned to me just before you called the committee to order that he was somewhat concerned that perhaps the next underwater experiment might be in the Arctic, and he really preferred the Virgin Islands.

While the aquanauts will address the committee following the introduction of the other agency representatives present, I would like to introduce them at this time, as they are the stars of this show.

First, Mr. Richard Waller, biological oceanographer with the Bureau of Commercial Fisheries and the senior aquanaut. Next, Dr. Edward Clifton, marine geologist with the Geological Survey; Mr. Conrad Mahnken, biological oceanographer; and Mr. John Van Derwalker, fishery biologist, both with the Bureau of Commercial Fisheries.

Mr. Chairman, that completes my statement, and following the remarks of the other agency representatives whom you may call upon, Mr. Richard Waller will be ready to give his impressions to this committee of the 60 days spent below the surface and to answer any questions that the committee might have.

Mr. Lennon. Thank you very much, Mr. Secretary.

Yesterday afternoon I was discussing this project with Admiral Waters and Dr. White of ESSA, and I commented about the cooperative effort on the part of so many agencies and the private industry sector in this project. They reminded me of a fact that is given

little public attention, and that is that the agencies of the Federal Government and the private sector are frequently involved in projects that don't have quite the dramatic impact and the public interest that this one does, but they wanted to reassure me that this sort of cooperative effort goes on constantly on projects which have not attracted so much national and international attention.

According to my list here, we are to have today representing the General Electric Corp., which was involved in this project, Mr. Edward Ray and Mr. Brendon Thompson, and whether or not you gentlemen are supposed to make a statement, I don't know, but if you are, we would be delighted to hear from you at this time.

Would you come forward, if you will, please, gentlemen.

Mr. PELLY. Mr. Chairman, while they are coming forward, I would like to call to the attention of the Secretary that he overlooked in his introduction a very important item, that two of these aquanauts are from my area, and actually it is a fact that Mr. Mahnken and I were at one time almost nextdoor neighbors on Bainbridge Island. I think that is very important for the record.

Mr. TRAIN. I didn't overlook that fact, Mr. Pelly, but I didn't want to deprive you of the opportunity.

Mr. LENNON. We are delighted to have with us the distinguished chairman of the full Committee of Merchant Marine and Fisheries, of which this subcommittee is just one small part. Chairman Garmatz, we are delighted to have you.

Mr. GARMATZ. I want to remind the Secretary to make sure at election times that the aquanauts are not underwater but will be in Mr. Pelly's district.

Mr. LENNON. Mr. Chairman, I might observe this morning that I was here before 10 but the distinguished gentleman from Washington with his friends, the aquanauts, was already before the camera.

Mr. PELLY. Actually what I am plotting is that, instead of jumping all the way from the Virgin Islands to the Arctic Ocean, I think they ought to go half-way to Puget Sound so their next project will be right in my backyard.

Mr. LENNON. Thank you.

Now, gentlemen, if you would identify yourselves to our distinguished audience, are you the coordinator, Admiral?

STATEMENT OF REAR ADM. O. D. WATERS, U.S. NAVY, OCEANOGRAPHER OF THE NAVY

Admiral WATERS. If you don't let me come on now, sir, I won't have anything to do.

Mr. LENNON. I am glad to recognize you now. I thought that was the plan, but I didn't know whether or not the Secretary was to present you or whether I should do it. We are delighted and honored to have you here. Adm. O. D. Waters, the Oceanographer of the Navy, and a great American.

Admiral WATERS. Thank you, Mr. Chairman and Members.

It is really an honor for me to be the sort of lead-off batter on this joint presentation of the details of Tektite I. Among our Naval representatives accompanying me here today we have Rear Adm. Thomas Owen, the Chief of Naval Research, who is also the Assistant Ocean-

ographer of the Navy for Ocean Sciences, and who also I might inject is a graduate of the University of Washington, and his home town is Seattle, sir.

He is accompanied by several members of his staff and, as you know, he and his staff were directly responsible for the conduct of the operations of the Tektite Project, and they will be available for such discussion as you may require.

As you know, Tektite I was a cooperative operation between Navy, NASA, the Department of the Interior and the General Electric Co. It was in itself a unique experiment involving a pioneering effort to perform a variety of scientific experiments on the ocean floor over a longer period of time than had ever before been attempted.

It has been marked, I am very happy to say, by complete success in all of its objectives.

To sort of emphasize what the chairman said a moment ago, we are all proud of the successful cooperative flavor of Tektite I, but it would be unfair to say that this particular characteristic of this operation was unique. This is because there are many other ventures now being carried on in a cooperative spirit between several agencies of the Federal Government and some include cooperation with industry.

I think this is a very important point to make about a situation that is gratifying to all of us in the ocean business.

In describing to you the different objectives of the participants in Tektite I and their accomplishments, we will begin with Mr. O'Neal, who is the Director of the Ocean Science and Technology Division of the Office of Naval Research, and who was the operational director of the project.

He will be followed by a spokesman from NASA, General Electric, and the aquanauts from the Department of the Interior, in that order.

You will notice that we suggest the appearance of the real stars of Tektite I as the final and principal attraction and which we consider as most fitting.

If it meets with your approval, our speakers will make their presentations as briefly and succinctly as possible one after the other, inviting you to ask questions of any of them after the aquanauts have made their presentation.

We also have with us a 17-minute film which we are prepared to show if time permits.

I should now like to introduce Mr. H. A. O'Neal.

Mr. LENNON. Thank you, sir.

Come forward, please, sir. Let me say, gentlemen, that if any other lady comes, will someone on the staff bring her up and seat her so that these gentlemen won't have to stand. Any lady that comes in from now on, or any lady who cannot see, bring her up here on this lower row.

Go right ahead, sir.

STATEMENT OF H. A. O'NEAL, DIRECTOR, OCEAN SCIENCE AND TECHNOLOGY DIVISION, OFFICE OF NAVAL RESEARCH

Mr. O'NEAL. Mr. Chairman and members of the committee: The Office of Naval Research conducted the Sealab I and Sealab II exercises a number of years ago, introducing the concept of man living under the sea in America. Under this program one of the major ob-

jectives was to determine how well humans can perform while they live in this environment.

After this effort, the last effort, Sealab II, psychologists from NASA and the Navy were discussing the results of these programs and wondered if the data obtained on small groups of men under sea could not be related to the crew performance problems for long manned space flights.

Simultaneously the Navy, we in the Office of Naval Research and others, were interested in further exploration of this technique of man living under the sea and how well he could perform his work, looking at both scientific and engineering problems.

Scientists in the Department of the Interior, as Secretary Train has said, were interested in looking at this technology.

The General Electric Co., Missiles and Space Division, evidenced an interest in entering the field of oceanography. These interests all melded, got together, and the result is Project Tektite.

If I may, we have some slides which I would like to show, giving a quick overview of the program.

The essence of Tektite was to have four scientists live for 60 days under saturation conditions on the ocean floor at about 50 feet in the Island of St. John, and about a year ago we selected a schedule date of February 15 through April 15, 1969.

The mission as it was derived from the goals of all agencies obtained behavioral data and crew performance as a function of time for an isolated team of men living in a hostile environment doing a real task in which they were interested, to see if the scientists could extrapolate to space missions.

Further exploration of saturation diving, underwater construction experience, the collection of ocean science data itself, collect physiological and human engineering data on the men while they were living down below, and to test ocean engineering technology.

The Navy acted as the lead organization providing overall program management, logistic support, technical support, and partial funding.

NASA provided technical support primarily related to the experimental psychology aspects, partial funding.

Department of the Interior provided the scientists-divers who have been introduced to you and the equipment necessary for their conduct of the ocean science and of course the Park Service provided the site.

The General Electric Co. provided the ocean floor habitat, assisted with planning and execution of the program and the observation measurements and is currently analyzing much of the data.

In addition to the groups listed, the U.S. Coast Guard as a part of their national water safety program joined us providing divers and other assistance.

The organization of the actual operation was under a normal Navy organization to insure medical safety, to insure adequate logistic support and mission performance.

Money. Everyone always wants to know. In real money, direct costs, including contract costs, amounted to $874,000 distributed as shown between Navy, NASA, and Interior. Indirect costs shown on the right include such things as military salaries, backup requirements, the equipment, et cetera, and in the case of General Electric this is our estimate of their cost in actually providing the habitat from their own money.

This, of course, did not include public information costs, equipment wear and tear, et cetera.

The site selected was the island of St. John. We looked at some nine sites, including a site survey by the senior aquanaut of the major sites and selected a site in the National Park on the Island of St. John in the Virgin Islands. An actual photograph of the site from a hilltop showing the nice blue water, the semitropical or tropical foliage.

The actual underwater site was just beyond the ship which can be seen in the center of the slide.

GE built the house. You will hear a detailed description of the habitat a little later. The Seabees built a place called Camp Honeysuckle on the island to house the support personnel. A major control station was built to insure safety of the aquanauts providing monitoring 24 hours a day of their activities and of the principal life support features.

On February 15, as scheduled, Acting Governor King of the Virgin Islands shook hands with the boys. They had not at this point grown their beards, as you can see. They went over the side on schedule.

In spite of our modern-day technology, the Seabees wound up devising methods of transportation which have been used for a large number of years.

Early on the morning of April 15, the aquanauts entered the personnel transfer capsule on the ocean floor. The capsule was sealed and brought to the surface. The men were transferred from this capsule to the major decompression chamber, the blue chamber in the bottom of the photograph, and spent some 20 hours during which the pressure was slowly lowered to the pressure of our normal atmosphere, and they reentered our normal world on schedule, having accomplished all of the objectives of the program safely and, while we do not yet have the data from the computer, we are sure that it will justify manifold the expenditures.

Thank you, Mr. Chairman.

I would like to introduce Mr. Douglas Lord of the National Aeronautics and Space Administration as the next speaker, with your permission, sir.

Mr. LENNON. Thank you, sir.

We are delighted to have you, too, Mr. Lord.

STATEMENT OF DOUGLAS R. LORD, DEPUTY DIRECTOR, ADVANCED MANNED MISSIONS PROGRAM, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. LORD. Mr. Chairman and members, I would like to take this opportunity to acquaint you with some brief historical facts about Tektite as viewed by NASA.

Two years ago informal discussions were initiated by NASA with the Navy on the possibility of obtaining data useful to long duration space flight for man's involvement in the ocean. As a result of these discussions two study contracts were awarded by NASA to examine the premise that experience in an underwater environment would be useful in obtaining data beneficial to the planning of long duration manned space missions.

The study program extended for approximately 6 months and was guided by a joint NASA and Navy committee. The study program

was completed in January of 1968, and as a result of the conclusions and recommendations, the Tektite program was initiated and a Tektite I mission formulated.

The program has been of special interest to NASA in trying to obtain data on crew performance during extended operational missions. We feel that the environment in which the mission operated was in many aspects a better test of man's adaptability to long space missions than can be obtained throughout the chamber simulations.

With this brief introduction, I would like to introduce Mr. Eugene Burcher, the NASA program director for Tektite, who will go into more detail about the NASA interest and participation in this program.

Mr. LENNON. Thank you.

STATEMENT OF EUGENE S. BURCHER, PROGRAM DIRECTOR FOR TEKTITE FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. BURCHER. Mr. Chairman, members, NASA's three main interests in Tektite project were from the behavioral program standpoint which was to evaluate the dynamics of small groups; the biomedical program, to collect biomedical data on the particular mission conditions; and the habitability evaluation where we looked at various aspects which could be extrapolated to extended manned space flight.

The behavioral program itself evaluated individual and group behavior and performance capability while accomplishing—and the key words were—a real mission—in other words, not makeshift or planned activities—over long duration in a stressful confined environment.

Some of the behavioral objectives are listed here: To try to get time-cost information on a crew of four scientists and to relate individual and group behavior on an overall mission performance and so forth.

Some of the means of evaluating and gathering this particular data are these particular aspects. Psychomotor testing in which we used a piece of equipment which is going to be actually used on some of our long duration flights to evaluate performance of the crew.

Automatic data recording and audio-video, on which I will go into a little more detail later. This consisted of closed circuit TV cameras and open-circuit microphones; direct physiological recording done by EEG methods, and I might add that this EEG is the same tape that will take analysis of the sleep on some of the Apollo flights and, of course, diaries and report forms.

Here is a picture of the inside of the behavioral van with two of the monitors monitoring the four screens that were connected to the four compartments of the habitat. They took the data down, punched it on punch cards for later evaluation in Washington.

Some of the preliminary behavioral conclusions were, one, overall that the crew of four people could live for an extended period of time in confinement doing work; various aspects of the work performance.

Something of interest here which could possibly be used in flights is that there is a period of shakedown getting used to your habitat and getting your equipment lined up before you actually enter into your mission.

There was a desirability to have a habitat engineer on future missions to allow the crew to contain themselves primarily with their scientific work rather than with habitat functions, and an item of interest is that over the period of the 60 days there was actually an improvement of performance and diving efficiency rather than a deterioration, degradation which possibly could have been expected.

We had very little problem with the crew themselves. There was sometimes some anxiety or friction expressed with the command structure or the mission director above, and that may have been a way of just letting off some steam.

Personal adjustment. The crew actually adapted itself to later sleep-work cycles. One of the areas of relaxation seemed to be the evening meal where they would get together and discuss the day's activities and this performed the relief from their duties.

Also their diving provided relief from confinement to the habitat and allowed them to get outside and breathe a breath of what you might say "fresh air." They considered the habitat itself as a very livable configuration but, however, needed a little more room to do their scientific work and of course this could be applicable to space flight.

We may have to take a look at the size of the area to do their scientific work versus the living quarters.

One of the various aspects that they considered very important was the variation of color schemes. This relieved them of the monotony of one continuous color; in other words, gave them a change such as the four seasons of the year. They found this desirable.

Here is a picture of the crew quarters. In the background you can see the TV monitoring camera and right at the center of the screen you can see the microphone used for monitoring conversation to gather the data.

The curtains were for privacy on the bunks and proved useful. Here is the picture of the bridge. The main aspect that I want to bring out is the varying color schemes. It did provide relief to the crew.

NASA's primary biomedical interest was in the hematology area of blood. We did the same blood studies on Tektite that we have done in Sealab and are doing on the Apollo program.

Our Manned Space Craft Center in Houston was the primary center involved in this with the support of the various academic institutions listed here. We also had a direct interest in the data management and analysis of the data gathered on Project Tektite.

During the course of the mission over 20,000 computer punchcards were punched on site. This provided in the neighborhood of 100,000 bits of data information. The cards were then, after being punched, sent back to Washington, and processed and are now in the storage bank at the NASA computer.

This storage bank concept gave us the ability to analyze the various mission aspects such as marine science information, the behavioral information with the habitat information such as what was the atmosphere on a certain day, the water condition.

It gave us ability to correlate various bits of information. NASA funding, as brought out by Al O'Neal, was a total of $400,000. Of this the Office of Manned Space Flight contributed $250,000 and the Office

of Advanced Research and Technology, $150,000, $200,000 direct transfer to the Navy and the rest inhouse work such as modification of equipment, the running of the emergency decompression schedules at Houston, and things of this nature.

With this brief summary, I would like to say that NASA feels from its participation in this project Tektite that we have gotten our money's worth and would like to express our feeling of cooperation with the other agencies and it has been a pleasure working with them.

With this summary, I would like to introduce Mr. Edward Ray, who is the Manager of the Ocean Systems Division of the General Electric Co.

Mr. LENNON. Thank you, sir.

STATEMENT OF EDWARD RAY, MANAGER, OCEAN SYSTEMS DIVISION, GENERAL ELECTRIC CO.

Mr. RAY. Mr. Chairman and members, it is a privilege to be here today and represent the General Electric Co. view of Project Tektite, its genesis and its significance.

As the previous speakers have mentioned, the Tektite Project had its beginning in a study our Missiles and Space Division performed 2 years ago for a joint NASA-Navy council.

One of the conclusions of that study was that much could be learned in the area of space crew performance and behavior through an underwater research program since a significant number of parallels can be drawn between manned operations in the ocean and in space.

The parallels are due to the similarity of the isolation and the occupational stresses which occur in man when he performs a complex mission in a hostile and alien environment.

Because of these factors and because of the expressed national interest in the development of ocean resources, the General Electric Co. decided to furnish the Tektite undersea habitat as its investment in this field.

The habitat was patterned after a space cabinet design used for earlier manned studies. After NASA and the Navy reviewed our study conclusions, they initiated a pilot program of underwater operations known as Tektite I.

Since the validity of the behavioral program was dependent on the performance of a real mission, the Department of the Interior was invited to perform a meaningful marine scientific program and provide the aquanauts who would perform it.

General Electric, besides developing the habitat, served as the prime industrial contractor responsible for the inter-division of all the technical aspects of the program as well as providing onsite support.

Now that the original program goals have been successfully accomplished, on a very compressed schedule I might add, and the value of the technique demonstrated, it is worthwhile to examine the overall significance of the Tektite Program, even though the detailed scientific results are still being evaluated.

We believe that Tektite was of major significance in a number of important respects.

First, the technical mission itself, that is the continued development of saturation diving techniques and the additional medical, behavioral

and marine science knowledge obtained is important to this Nation's continued exploration of the oceans.

Second, the application of air space technologies to the Nation's ocean needs is contributing to social and economic progress by using sophisticated tools developed and paid for already by our Nation.

Third, the cooperative venture between the public and private sectors in programs of national scope made possible by the interagency and industry Tektite team offers a valuable model for the effective accomplishment of future programs.

It gives me great pleasure now to introduce to you Mr. Brendon Thompson, the General Electric program manager for Tektite, who will describe the underwater habitat and associated equipment.

Mr. LENNON. Thank you, Mr. Ray.

STATEMENT OF BRENDON THOMPSON, GENERAL ELECTRIC CO. PROGRAM MANAGER FOR PROJECT TEKTITE I

Mr. THOMPSON. Mr. Chairman and members, I will now give you a short summary description of the equipment, both the habitat on the bottom and the equipment on the surface, that comprised this mission.

May I have the lights, please.

The major considerations that influenced the design of the habitat were as follows:

First of all, we were designing for the crew of four scientists who represented a group size of interest to the psychologists both in NASA and Navy. We were going to be located in 50 feet of water approximately, which was the depth of interest to the marine scientists, and, third, that it was going to be a 60-day submersion, which approaches the length of space missions in the near future while minimizing the program cost and maintaining high safety standards.

The design of the habitat and its associated systems was started in the early months of 1968 and work proceeded through the summer at the Valley Forge plant of the General Electric Co. Final assembly of all equipment was completed at the Philadelphia Navy Yard in December, and on January 6, 1969, exactly on schedule, a Navy ship departed for St. John, Virgin Islands, with the operating equipment which was to be used on this program.

The major operating elements required to sustain the aquanaut crew on the ocean bottom consisted of two groupings of equipment. The first grouping consisted of surface barges and control center, housing all the necessary machinery to supply the vital services of air, water, electrical power and communications to the submerged crew on the bottom.

The second grouping consisted of the habitat and its appurtenances, together with auxiliary equipment needed to sustain the crew in safety and comfort.

Mr. LENNON. May I interrupt you a minute. Would it be helpful for you to come and sit by Chairman Garmatz? There is a little light.

Mr. THOMPSON. I am afraid the cord is not quite long enough, Mr. Chairman. Thank you very much for your consideration.

The second grouping consists of the habitat and its appurtenances, together with auxiliary equipment needed to sustain the crew in safety and comfort when they were outside the habitat.

The laboratory was connected to the surface by means of umbilicals, hoses, and cables.

That is a view of the surface complex comprising two barges. The barge in the foreground contained most of the lifting equipment. The barge in the background contained the control vans and the various pumping machinery required to supply the life support services referred to earlier.

Now, within the interior of the van shown there the control of the day-to-day operations was completed. This housed the operational consoles used by the watch director, the medical officer and the technical observers, as well as the television and voice recording equipment alluded to by Mr. Burcher of NASA.

All communications with the submerged crew were handled through this van.

Near the control van the decompression chamber and a crane mounted personnel transfer capsule was located and at the end of the mission the crew transferred into that capsule and were restored into the decompression chamber, the object there in the foreground.

They stayed within that chamber for approximately 20 hours before emerging on the surface.

I pass now to the habitat itself, a model of which is in the foreground here in the room.

The habitat consists of two vertical cylinders mounted on a rectangular base and interconnected to each other by a crossover tunnel. The cylinders are 12.5 feet in diameter and the entire habitat measures about 25 feet from the base to the top of each cylinder. A cupola for observation purposes is located on the right-hand cylinder. The cylinders are divided into four compartments consisting of crew quarters in the lower left, the bridge—upper left, the engine room—upper right, and the wet room—lower right.

I will now give you a short description of each of those four rooms. The crew quarters contained the berthing, food storage, cooking, general housekeeping arrangements, together with equipment for entertainment, private communications with the surface and the measuring and recording of sleep state. An emergency hatch was located below the floor for egress from the habitat if needed. Provisions were made for emergency lights, and two means of air supply, one portable and one fixed.

This particular slide is taken from the outside looking in through one of the domed portholes that abound around the habitat.

We move upstairs now to the bridge. The bridge served as a communications and control center as well as a study room for the crew. The equipment located in the bridge consisted of instruments to measure the composition of the habitat atmosphere, a main communications console, and an alarm panel to indicate emergencies and emergency provisions for light as well as breathing air.

We are now in the wet room, and the wet room was intended to serve, and did serve, as a working laboratory area.

It had provisions for the donning and doffing of diver equipment, a fresh water shower, dryer for towels, and so forth. Provisions were made for charging of air tanks used on normal excursions. A large counter and sink were used to prepare marine specimens for study and analysis. The main entry hatch was located in the floor and that served as the normal route for entry and exit from the habitat.

This slide shows the engine room. The engine room itself contained pumps, blowers, and filters for maintaining the atmosphere, as well as the major electrical power distribution equipment. This room also contained the toilet facilities.

You can see the ladder which led to the cupola to serve as an observation post both for marine life as well as for safety if there were divers in the vicinity of the habitat.

This slide shows the egress hatch in the center of the picture. Once outside, the crew passed through a grill construction shown there which was known as the shark cage and served protective needs.

When outside the habitat the crew could be monitored by one of their number from the domed windows located around the various compartments. These are just sequential shots of one of the crew looking out through the domed window.

For excursions other than to a local area, way stations were provided for safety, rest, or conversation. These way stations had independent air supplies and were connected to each other and the habitat by a sound-powered phone system.

In general, the design philosophy used throughout was to start with a tried and proven space cabin interior, adapt it for an undersea mission and provide a very high degree of assurance that the crew could operate comfortably and safely for the duration of their stay on the bottom.

As yet, the engineering data obtained on this program has not been fully analyzed but trends examined thus far lead us to believe that it has been demonstrated that a space habitat and an undersea habitat have a great deal in common particularly as far as the human needs of its crew are concerned, and that a program of the scope of Tektite can be accomplished for a relatively modest sum of money with a worth in data far in excess of its actual cost.

Thank you, sir.

Now, Mr. Chairman and members, I would like to introduce the four members of the Interior team that actually inhabited the habitat, if I may say so, and to lead them off, Mr. Richard Waller will now speak.

STATEMENTS OF RICHARD WALLER, CONRAD MAHNKEN, JOHN VAN DERWALKER, BUREAU OF COMMERCIAL FISHERIES; AND DR. EDWARD CLIFTON, GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

Mr. WALLER. Mr. Chairman, members of the committee, may all of us come up to the table here?

Mr. LENNON. Yes, if it is convenient for you, gentlemen.

Mr. WALLER. First of all let me say that I would like to speak for all of us in saying that it is with a great deal of pleasure that we are here today and we thank you for inviting us. Before I go on with a slide presentation, Mr. Chairman, I would like to correct one small statement that was made earlier since this is for the record.

The Interior Department was not simply invited to participate in Tektite. The Department of the Interior was actively involved in its conception, planning, and implementation throughout. If I can have the lights now I would like to go ahead with your permission and show a slide presentation.

Mr. LENNON. Thank you.

Mr. WALLER. This is the habitat you saw earlier as it appeared under the bottom. This shows some of the reef area immediately surrounding the habitat and some of the very abundant and colorful marine life.

More of the same.

This is in essence the way we went to work every morning and this shot of myself and John Van Derwalker is where we put our suits on and our tanks just prior to departing down through the access hatch immediately in back of us.

After going through the access hatch, there is a small tunnel through which you must go to get to the outside and this shows the shark cage we passed in and out of when going from the habitat out into the working area.

A scene showing two of the divers on their way to work at one of the many projects we had scattered around the reef area.

These were very strange working conditions. We simply picked out a piece of coral on the bottom and sat down and made our observations and took our notes, and recorded our data. All quite different from the way you normally do things, say at a shoreside laboratory.

In this scene I think Ed Clifton is busy charting and mapping some of the coral formations and geological features of the surrounding area.

This shows one of Ed's experiments. The greatest value of Tektite or any underwater house to a scientist is that you are not restricted to taking the data point and then depending on that as being entirely representative.

By being down there, by having the scientist in the environment himself, he can study the processes and changes that you normally only get by taking measurements from surface ships.

In this particular shot he has put some fluorescent sand around a reference stake and was able to go out day to day and even hour-to-hour to determine how much the marked sand had spread and how the currents in the area were affecting this tagged sand.

These are spiny lobsters, a delicacy in many parts of the tropics. During Tektite John Van Derwalker subjected these animals to one of the most intense studies I think that has ever been done in such a short time.

They were very abundant in the area around the habitat and since so little is known of their reproductive behavior, their migration and other life habits, Tektite offered an amazing and wonderful opportunity to study these things.

John would go out with help from one or the other of us each day and capture the lobsters and then record pertinent information on the sex, the size, and other biological information on the lobster, and while the two of them were sitting down on the bottom they could take the measurements and also affix small tags shown here so that any time that lobster was seen from then on he could be immediately identified and his movements from the time he was first captured could be recorded.

Another method of determining the movements of the lobsters was with a sonic tag.

In this scene you will see a small device on the lobster. This device emitted a very high frequency beat or tone and after the lobsters were tagged like this they were released back to their burrows and with

this device, developed originally for the salmon tagging programs by the Bureau of Commercial Fisheries in Washington State, the lobster could be located and you could home in to the lobster any time of the day or night. He simply could not hide whether he was in a burrow or at some far distance out over the plain.

You could swim immediately to him and record what his activity was at that precise moment, whether it was feeding, reproductive behavior, movement or what.

This scene shows Conrad Mahnken working with his standpipe. Connie was measuring productivity of the coral reef area while we were down there and he was doing this by pumping quantities of ocean water down through this plastic pipe into the habitat and filtering off plankton and other organisms and measuring just how rich the ocean area was.

This map shows some of the scientific areas we had set aside. The cross marks the habitat site, and you can see there are areas marked off involving the total scientific study that were far beyond our ability to swim to every day from the habitat. Not only was it beyond our ability to swim to it because of distance but because of the water depth.

We were restricted to swims of no deeper than 100 feet, and no shallower than 20 feet. In the saturation method that we were in, these were our upper and lower limits.

In order to be able to move around freely and work away from the habitat we used way stations. They were security items that were located at some distance around the periphery of the habitat offering a place of shelter in the event we had been bothered by any predator organisms and had extra air tanks inside.

Our work was very much aided by our surface scientific support team. In the shallow areas which we could not penetrate and the deeper waters and the distant areas we had a crew of three alternate aquanauts and since there were no particular problems encountered by the original four-man crews they functioned as a surface support scientific team to in essence spread the scientific work out.

They also engaged in lobster tagging techniques on the surface and permitted a much wider range of the lobster studies.

There were many things to do in the habitat, one of which was maintaining a safe and low carbon dioxide level. This was done by replacing old Baralyme which was used to scrub the CO_2 by fresh Baralyme every certain number of hours.

Here John Van Derwalker is changing the Baralyme in one of the cannisters.

This is, I guess, a typical meal. It looks like spaghetti and a bottle of wine there, I think.

This is exactly what it looked like on the mission. Generally one person would be responsible for preparing the meal and someone else would do the dishes.

Needless to say, we stayed very busy with all of these little household chores that we had to do as well as engineering and scientific tasks.

When we did have transfers, that is, when it was necessary to send materials or items up to the surface, or materials down to us, we used this large pot, and materials were put inside, the top was clamped

down and this device was lowered down and we wrestled it into the habitat and made our dry transfers.

It is rather primitive but it worked very well.

This is the decompression complex that was standing by throughout the 60 days in the event there had been an emergency and anyone required emergency decompression. This did not happen so fortunately we only had to spend 20 hours, the four of us, in that blue cylinder there and that was quite long enough.

Mr. Chairman, and members of the committee, that concludes the slide presentation, and if you or members of the committee have any questions for any of us we will be delighted to try to answer them.

Mr. LENNON. Thank you very much, sir.

Someone has suggested the question, where did the name Tektite come from? What is its origin? To what is it related?

Mr. WALLER. Yes, sir.

I think our geologist had better answer that.

Dr. CLIFTON. Tektites are small pieces of mineral matter that apparently are derived from space, fall into our atmosphere and are trapped and are found on the ocean floor.

The name was chosen because it reflected the interest of the space agency as well as the interest of the ocean agencies.

Mr. LENNON. That answers the query that was in our minds as to where you got this name.

What is the possibility about the utilization of this underwater habitat in the future? It is to be related, of course, to depth, I suppose. Does it have any potential use for the future in the same depth?

Mr. WALLER. I would like to answer that, Mr. Chairman.

We are all agreed that the Tektite habitat could have been left in the same depth at the very same location and I am not able to predict with a great deal of certainty just how many years that productive marine research work could have been done but I am sure that it is more than 2 if it had been allowed to remain in the same spot and have a continuing team of marine scientists come down and do specific projects.

Possibly no one scientist might have required 60 days because in order to get a marine scientist down in the environment in direct contact with these animals that he is working with in some events it would only require 2 or 3 days, maybe, and it might be worth years of inference that he might have been laboring under. That is just in the Lameshur Bay spot.

I think that a habit in almost any shallow water area while these deeper techniques are developing could pay off handsomely for the marine science program at this point.

Mr. LENNON. Could this particular one be used in some other area where the temperature of your water was considerably different from what you had there?

Mr. WALLER. Yes, sir. It certainly could.

To operate the habitat in a colder water area right now probably would require removing the refrigeration system and putting in a heater plant.

Mr. LENNON. I am thinking in terms of the distinguished member from the State of Washington.

Mr. PELLY. Thank you very much.

Mr. LENNON. It can be utilized out there.

Mr. PELLY. Just a little insulation and it can go right in to Puget Sound.

Mr. LENNON. You have the record, gentlemen.

It was engineered and configured and constructed for depths not exceeding approximately 50 feet.

Mr. WALLER. Well, as long as you have an adequate internal pressure that corresponds with your external pressure—I am not an engineer so I can speak very freely on these engineering subjects—I don't see any reason why the habitat could not be used down to depths of 150 feet.

Mr. LENNON. You gentlemen have been introduced, the four of you. I wonder if we could not have a word from each of you.

Is there anything you want to say about your experience? You say you are delighted to be here. I say that we are delighted and honored to have you gentlemen here and that applies to everyone identified with this project.

Mr. VAN DERWALKER. Thank you.

Mr. Chairman and members of the committee, I am quite pleased to be here this morning. I would like to express my interest in furthering this type of work because if we are going to study the processes that occur in the ocean we are going to have to be there to watch them. We can get points of data and try to connect them but, in order to get some continuity to our study and particularly behavioral studies, I think we will have to go down there.

I want to say I enjoyed very much going down and living with the fish, and look forward to an opportunity to do this again. I think if we are to reap the wealth of the Continental Shelf that this is the way to go.

Thank you.

Dr. CLIFTON. Mr. Chairman and members, I think that perhaps one of our most important functions down there as marine scientists was the evaluation of saturation diving from an underwater habitat as a scientific tool.

As for myself, when we began this experiment I really did not know whether useful research could be conducted under the restraints with which we had to operate, and I think Tektite demonstrated very well that research can be done quite well from an underwater habitat. Particularly in my own field of geology in the exploitation and exploration of mineral resources on the Continental Shelf. I think that the underwater habitat indeed has a place in the future.

Mr. MAHNKEN. Mr. Chairman and members, I would like to take this opportunity to recommend Puget Sound as a possible site for a future Tektite.

Mr. LENNON. I commend you.

You are not only a scientist and engineer and an aquanaut but you are a politician, too.

Mr. MAHNKEN. Thank you, sir.

Mr. LENNON. Go ahead, sir.

Mr. MAHNKEN. There is a large amount of interest in the scientific community in the Puget Sound region for a habitat such as Tektite.

They would eventually like to place an underwater habitat on Cobb Seamount which is located some 200 miles off the coast of Washington.

The depth of the top of the sea mound is about 120 feet and would be used primarily as an observational platform for measurements in the open ocean.

However, we feel very strongly that you have to develop the expertise, both technological and scientific, in a shallower and more protected environment, and we feel that the ideal place would be in Puget Sound. The habitat could be located——

Mr. LENNON. You mean you or we.

Go ahead for the record.

Mr. MAHNKEN. We feel that.

Mr. VAN DERWALKER. Connie is speaking for me.

Mr. MAHNKEN. I am speaking for John Van Derwalker and myself and Mr. Pelly. The habitat could be located from 60 to 100 feet very nicely in Puget Sound.

In the meantime the possibility could be explored and studied for using the habitat as a possible station for operating under water pens for the use of aquaculture. There are interests in Puget Sound now that have a very strong desire to further the potential of aquaculture in Puget Sound. It could be used as an underwater platform for technicians and scientists for studying underwater pens of salmon or underwater rafts of mussels and oysters and other marine organisms.

I thank you very much.

Mr. LENNON. Where would you like for us to take that excerpt from the record and send it?

I was going to come to the point for every member of the committee to have an opportunity to question not only the four aquanauts but also anyone who has spoken here this morning, and I want to recognize our distinguished chairman first.

Mr. GARMATZ. I wanted to ask the gentleman if he had any aspirations to run for Congress up in Washington.

Mr. MAHNKEN. No, sir. I have a very fine Congressman from my district already.

Mr. PELLY. Mr. Chairman, I hope you have not forgotten that I voted for your jellyfish bill.

Mr. GARMATZ. Thank you.

Mr. LENNON. Any other questions from our distinguished chairman on the record?

Mr. GARMATZ. I am sorry I was a little late getting here. We have an authorization bill coming up today and I am trying to make a few notes.

On behalf of all the members of the committee, I am most happy to welcome you gentlemen here.

As the chairman of the subcommittee said, you are doing an excellent job. Unfortunately I was not able to hear as much as I would have liked, although I want to compliment you gentlemen on a very good job, and I must say that the slides are very informative.

I wish you luck in all your endeavors whether in the State of Washington or in the Chesapeake Bay of Maryland.

Mr. LENNON. Thank you, Mr. Chairman.

At this point I am going to ask unanimous consent that there be printed in the record or published in the record the picture that I have here of you four gentlemen.

I don't know that you would recognize but one of you now from this picture. We don't usually do this but if it can be done I would like for it to be done.

Now, the gentleman from Washington.

Mr. PELLY. Thank you, Mr. Chairman.

I want to join you in welcoming these very distinguished men before our committee. We have a very great interest in oceanography and on the serious side I would like to propound one or two questions that I think are important.

One is with regard to the breathing apparatus which enabled you to make excursions from the habitat. I understand that you were critical, according to the Seattle Post-Intelligencer in my district, of this breathing apparatus. Could one or all of you comment on that?

Mr. WALLER. I would like to comment on that, Congressman.

We used underwater breathing equipment in Tektite of a very old type. It is about 30 years old, as a matter of fact, not this particular model but the design itself.

I think we all strongly feel that there is a very definite need to develop new and better equipment than is now available if we are indeed serious in our discussions about Continental Shelf exploration and exploitation and management.

I personally feel that there is a great deal of underwater development or undersea technology development now going on in the military and I am not at all convinced that this particular development is answering the nonmilitary needs and it probably should not because military programs should satisfy military needs first.

But I do strongly urge that there be a greater effort made in the development of underwater needs for nonmilitary functions.

Mr. PELLY. I understand that there are much better types of breathing apparatus available, and I was wondering whether there were any financial or other constraints that caused those who were providing the equipment not to give you better equipment.

Mr. WALLER. Well, there is, of course, better equipment available. I am afraid that there was an oversight on many of our parts in Tektite. In regard to one particular piece of breathing equipment that we had planned on using it was decided that quite possible there had not been enough test and evaluation on this rig. I am not really sure what the reasons were, but I know it was classified and at the last minute it wasn't available to us.

Mr. PELLY. Mr. Chairman, I wonder if Admiral Waters could comment on the classification of the breathing apparatus. Was that done by the Navy?

Admiral WATERS. Mr. O'Neal will take that. I am not quite sure I have the details.

Mr. PELLY. Is it true that the Navy classified the one type of breathing apparatus which they had hoped to have for this project.

Mr. O'NEAL. Yes, sir.

Mr. PELLY. Why is that?

Mr. O'NEAL. The story is that the General Electric Co., the same department in fact, has developed a new breathing apparatus. There are about three developmental models available.

Some of the techniques have been classified as of the present time. The equipment is still undergoing evaluation in the Navy. The real

reason it was not used in Tektite, sir, was not classification but the fact that they are developmental models and the developmental testing has not yet been completed to a level which would let us use the equipment with the required degree of safety.

Mr. PELLY. Isn't there equipment similar to the General Electric which is available and has not been classified?

Mr. O'NEAL. I am not capable of answering that. I simply don't know.

Mr. WALLER. I would like to try to answer that, Congressman.

Yes, there were other equipments available. We did not know that we were not going to be able to use this one particular unit that the General Electric Co. had developed and, when we did realize this, of course, we were fighting another very serious constraint and that is that we are funded quite low on this project. It was a shoestring-type funded operation, and I think that this area of equipment will get a strong look on the next project that is conducted and, with the demonstrations made in Tektite, on the scientific program and a scientist's need to get down into the environment, I hope that there will be many other Tektite-like projects from now on.

Mr. PELLY. On the next project which I understand is now going to be on Puget Sound, I trust you will not be denied the type of breathing apparatus that will allow you to get the maximum out of this particular type of research.

I thank you very much.

Mr. LENNON. The gentleman from Florida.

Mr. ROGERS. I thank you, Mr. Chairman.

All of us are very much impressed with what you have done, those associated with Tektite.

I would hope that the Nation can have brought to its attention the importance of what you have done in my own mind for the benefit of this Nation as important as the space flights.

I don't think we have quite yet equated what is being done in the seas as a beginning with what has been done in space. I think we need to do this. I am sure this committee has as its purpose trying to impress the American people with the great benefits that will come from activities such as yours to this Nation and in my own mind even greater than we have been obtaining from space.

Also, I am impressed with the fact that my colleague, Mr. Pelly, is as concerned as I am with what has been done here in our discussions on shoestring support, and that is about what we have had in the development of the seas from our development of the seas from our national efforts in many areas. This committee hopes to change that too.

What procedures did you have or did you have any particular procedures where each man checks his own equipment before you went out of your habitat?

Dr. CLIFTON. Yes, very definitely we did. I think we almost decided among ourselves at the outset of the experiment, and really did not discuss it much but just undertook it, that each person was responsible for all of the equipment that he took into the water.

In addition, however, we also checked each other's equipment as we went in. This was just a standard safety check to make sure that the other person's air was turned on, that he had his safety balloon. This was done as routine.

Mr. ROGERS. Did you have any difficulty as far as the safety factor? Did anything happen?

Dr. CLIFTON. Not really.

Mr. ROGERS. No real problems.

Dr. CLIFTON. No real problems at all.

Mr. ROGERS. Of course, we had an unfortunate situation and I wonder if techniques there might have changed that situation.

What about the use of submersibles in the whole project? Were there many submersibles used or could they have been used, or could they be effective in helping you carry out your mission?

Mr. WALLER. In the Tektite project itself it would have been very good to have had a swimmer delivery vehicle to permit us to range a lot further away from the habitat.

The swimmer delivery vehicle, of course, would not have been of much use without a long-duration breathing unit. We needed both. There were other equipment items needed also. I am sure that careful attention is going to be paid to these equipment lacks in the future.

I might say generally that I feel that submersibles are in the same category as undersea habitats. I think they are all new and exciting tools to probe the oceans with.

Mr. ROGERS. I will agree with you and I would think it would be very helpful to have them as you say carry you from one spot to the other from your habitat and get there perhaps more quickly and you could operate at a longer distance from your base.

Here again I am concerned with the fact that Defense has now cut the submersible joint fund there from $3 million at a time when we need to be making progress here and we have asked the Secretary, I personally, and I am sure other members of this committee have asked him to reconsider this.

I hope it will be done and I think your testimony today will help point up the need for more work in this area and the use of the submersibles.

When we found out about that we had about 1,600 requests for submersibles. Yet now we find we won't have sufficient money.

Finally, you were on time as to when the project was projected. You had no basic slippage.

Mr. WALLER. Well, yes, sir. We did have a little slippage. Some 8 months before the project started I had scheduled that we would begin the project on the 15th of February at 10 o'clock in the morning and we did not make it until 5 minutes after 12 on the 15th of February.

I might add that there was about 1 year and 1 month involved from the conception of Tektite until it was implemented and this just did not happen by accident.

There were many admirals on the Navy side of the House working weekends and evenings. A lot of hard work was done by the Office of Naval Research, by the National Aeronautics and Space Administration, and by many of the personnel in the Interior Department, and last but not least I understand there were several divorce actions pending in Philadelphia because of all the time the General Electric people were putting in building the habitat.

Mr. ROGERS. Let me ask this.

Were there any budget overruns?

Mr. WALLER. No, sir. There really were not any budget overruns.

Mr. ROGERS. Finally, the four of you are still on good speaking terms and are good friends after living together for 2 months.

Mr. WALLER. Probably even more so now than before because we depended quite a bit on each other down there.

Mr. ROGERS. We commend you and I know the entire Nation is grateful for your service.

Thank you.

Mr. WALLER. Thank you.

Mr. LENNON. Let me announce that we have a seventeen minute film and as you know the first order of business on the floor is the consideration of the maritime authorization legislation, and I hope we get at least the quorum.

With your permission I think we ought to go ahead now with the film and then stay in session as long as we can for questions.

We are delighted that you in the audience are here and you are welcome to see this film. Can you find yourselves seats so that you can see the film?

(Film shown.)

Mr. LENNON. Gentlemen, are there any questions now?

We will go as long as we can.

The gentleman from Virginia.

Mr. DOWNING. Thank you, Mr. Chairman.

I would like to add my compliments and congratulations for the splendid job that you gentlemen did. I think it is a great step forward. Since one of the prime reasons was behavorial problems, if any, were there any behavorial problems?

Mr. VAN DERWALKER. No, we got along just fine. I don't think we had any serious problems among the four crew members. Early in the dive we decided that if there were any little things that we did that another member did not like we should bring it out immediately and not let these things smoulder. We did. Connie had a compulsion to clean up everything. We could never find anything when we went back to our mess. We asked him to just leave our mess where it was. He cooperated and we did not have any problems thereafter.

I think we did have some confrontations with the surface group and this may have been an outlet as some of the psychologists have suggested, but I think we civilians and some of the military think in a different way and this could have been a problem. I think once we got to know each other things went very smoothly.

Mr. DOWNING. Did the fact that you knew somebody was looking at you affect your behavior in any way?

Mr. VAN DERWALKER. I was very conscious of this at the first of the mission for probably 2 or 3 days at the most. Having people watch us on the television did not bother me at all. However, you do like to keep some of your conversations private and this may have influenced us somewhat, although I don't think it was very serious.

Mr. DOWNING. One last question.

What was the most disagreeable facet of your life in the habitat?

Mr. VAN DERWALKER. I think the frustration of not being able to go out and spend more time in the water. I would have liked to have been

able to spend at least 6 hours every day in the water but we had to change the Baralyme and cook the meals and put certain pieces of gear back together occasionally and it was just simply a matter of wanting to spend more time on my primary objective and less time on the housekeeping.

I think we have had suggested this morning that there be a habitat engineer on the next crew and I think this is a very good idea. However, I think he should be a diver and allow him to get out into the environment because he is going to go stir crazy if he has to stay in all the time.

Mr. DOWNING. Thank you very much.

Thank you, Mr. Chairman.

Mr. VAN DERWALKER. I wonder if I could add one word here.

I think it is very important that in future development of underwater equipment that the scientific community have the option or ability to communicate with people who are doing this development and suggest perhaps some of the things that we need. Particularly in the military group I think that are developing equipment, and I would think it would be helpful for us to communicate with them.

Now, this may go on right now. I am not sure of it. But I know that I haven't had the opportunity and I would like to.

Thank you.

Mr. DOWNING. I think you should be provided that opportunity.

One final question.

Was there any other equipment particularly unacceptable to you or that you thought could have been improved?

Mr. WALLER. I don't know that there was any other equipment that was unacceptable. After having done this, we now have a much better feel for what equipment we were lacking and I am afraid that some of this equipment we were lacking has not even been developed yet. We have a long list of things that are definitely needed. Other equipment that we did not have was largely due to the fact that we could not afford it at the time but some of it was available.

Mr. ROGERS. Would the gentleman yield?

I wonder if you could submit that list to the committee.

Mr. WALLER. Yes, sir. I would be delighted to.

Mr. ROGERS. I think this might be helpful.

Thank you.

(The information follows:)

Equipment needs and developmental items it considered to be necessary or critical to future undersea habitat operations and conventional scientific diving:

1. Extended duration (closed-circuit) underwater breathing equipment.
2. Swimmer propulsion units for transporting devices from place to place on the seafloor.
3. Diver heated suits to permit diver/scientists to conduct extended research operations in colder waters.
4. Underwater communications and navigation equipment.
5. Underwater echo-location equipment (sonar) for monitoring divers and charting sample locations.
6. A wide variety of environmental monitoring instruments for use by saturated diver/scientists.
7. Additional work on development of decompression tables for saturated shallow water (100 feet) diving projects employing nitrogen as an enert gas instead of the more expensive and problem ridden helium necessary for deeper diving.

Mr. LENNON. Thank you.

Let me ask this question:

I take it that you four gentlemen have written a report. Since you represent the Department of the Interior, all four of you in fact, I take it that you have written a report which you all agreed on to a substantial extent in which you make known to the Department of the Interior up to the distinguished Secretary, who is here today, just what you implied or indicated here this morning. Your superiors in turn certainly would take that to the other cooperating agencies in this particular project and for that matter all agencies of the Federal Government for any project in the future.

I reiterate what the gentleman from Florida has indicated, that I don't know whether you will have to get permission to do it or not, but I hope that if that is what it takes you will be able to get it and submit to this committee a report in which you set forth in detail just your basic feelings about this matter with respect to equipment.

All of us express some concern as was indicated by the gentleman from Washington about the possibility that there might have been more advance in the technological field of the breathing equipment in some other place in the private sector of our total oceanographic's effort as well as the fact that this had not yet been approved by the Navy and, therefore, was not acceptable for this mission.

I believe that if there is going to have a meaningful impact it is inexorably related to this committee's consideration of the Commission's report related to the sea.

I don't know when and I don't know what position the administration is going to take with respect to the recommendations of the Commission report.

I am pleased to observe to you gentlemen and all of you interested in it that we do know that the National Marine Sciences Council has been authorized to make a study and make recommendations to the administration with respect to the implementation of the recommendations of that Commission report.

We expect that sometime after mid-June Dr. Wenk will appear, and we assume that he will speak for the administration.

We had the pleasure yesterday of hearing the Chairman of the Committee on Oceanography from the National Academy of Engineering who spoke quite eloquently to the subject, but he did not make any definitive recommendation with respect to the implementation of this program so far as two aspects of it were concerned, namely, the Commission's recommendation for NACO and the establishment of a Government structure referred to previously as NOAA. Yet, at the same time yesterday afternoon at 6 o'clock I received a communication from the Chairman of the Committee on Oceanography of the National Academy of Sciences in which they did definitely make a recommendation for the necessity of a new governmental structure.

So that I find that these two parallel organizations, the National Academy of Engineering and the National Academy of Sciences, both of them housed in the same building, one committee makes a definitive recommendation with respect to the report and the other holds back, and I am going to try to find out why.

I understand that there is a luncheon hosted by the General Electric Co., one of the participants in this program as a private enterprise, in which the members of the committee and their respective wives were invited to participate. I am told that. I understand that the invitation has gone out and that luncheon will be in B–339 in the Rayburn Building. I don't know who else is invited. I am told that some staff members, hopefully all of the staff members of this committee, were invited.

At this time as we conclude this program, for which we are truly grateful and honored that you would come here to give us an opportunity to see what can be done and what is being done and what we can project for the future, I would like to have not only the distinguished gentlemen who are now in the well, or just before us, stand, but also everyone who is here with any one of the participating agencies, namely, the Department of the Interior, the Department of the Navy, NASA, and GE, and anyone here who is identified with any of these agencies. Would you stand at this time.

I thank all of you gentlemen. I wish we could have heard from all of you.

With that, we will conclude the hearing. Thank you very much.

(Whereupon, at 12:05 p.m., the subcommittee recessed, subject to the call of the Chair.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

TUESDAY, MAY 20, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:15 a.m., pursuant to call, in room 1334, Longworth House Office Building, Hon. Paul G. Rogers, presiding.

Mr. ROGERS. The subcommittee will come to order, please.

We are honored to have as our first witness today an old friend of this committee who I am delighted to see here and whose testimony many times has been helpful to this committee in its deliberations, Dr. Paul M. Fye, who is president of Woods Hole Oceanographic Institution.

Dr. Fye, it is a pleasure to greet you this morning, and the committee will be pleased to receive your testimony.

(Dr. Fye's biography follows:)

Paul M(cDonald) Fye, 21 Challenger Drive, Woods Hole, Massachusetts 02543.

Born: August 6, 1912, Johnstown, Pennsylvania.

Education: Albright College, B.S., 1935; Columbia University, Ph. D. in Physical Chemistry, 1939.

List of Positions: President, Woods Hole Oceanographic Institution, 1961 to present; Director, Woods Hole Oceanographic Institution, 1958 to present; Associate Director for Research, U.S. Naval Ordnance Laboratory, 1956–1958; Deputy Chief & Chief, Explosives Research Department, U.S. Naval Ordnance Laboratory, 1948–1956; Associate Professor of Chemistry, University of Tennessee, 1947–48; Research Supervisor & Research Director, Underwater Explosives Research Laboratory of the Woods Hole Oceanographic Institution, 1942–1947; Research Associate, Carnegie Institute of Technology, 1941–1942; Assistant Professor, Hofstra College, 1939–1941.

Member: Member of the Corporation, Marine Biological Laboratory, 1958 to present; Committee on Oceanography, National Academy of Sciences, 1961 to present; Trustee, Bermuda Biological Station for Research, Inc., 1960 to present; Undersea Warfare Research and Development Planning Council, 1959 to present; Board of Visitors, Applied Physics Laboratory, The Johns Hopkins University, 1966–1968: Polaris Steering Task Group, 1956–1958; Polaris Ad Hoc Group for Long Range Research and Development, 1960–1965; Trustee, State Colleges of Massachusetts, 1966; Advisory Board, Naval Ordnance Test Station/Naval Weapons Laboratory, China Lake, California, 1965–1968; Board of Directors, Arthur D. Little, Inc., 1969.

Scientific Societies: American Association for the Advancement of Science: American Chemical Society; American Geophysical Union; American Physical Society; American Society of Limnology and Oceanography; The New York Academy of Sciences, Marine Technology Society, President, 1968.

Social Clubs: Cosmos Club, Washington, D.C.; Edgartown Yacht Club; Pi Tau Beta.

Honorary Societies: Sigma Xi; Phi Lambda Upsilon; Epsilon Chi.
Honors/Awards: Albright College, Sc.D., 1955; Distinguished Alumni Award, Albright College, 1951; Presidential Certificate of Merit, 1948; U.S. Navy Certificate of Commendation, 1960; U.S. Navy Meritorious Award, 1951; Bureau of Ordnance Development Award, 1946; U.S. Navy Certificate of Commendation, 1966.

STATEMENT OF DR. PAUL M. FYE, PRESIDENT, WOODS HOLE OCEANOGRAPHIC INSTITUTION

Dr. FYE. Thank you, Mr. Chairman.

I have brought with me a prepared statement which I believe is before you. If I may, I would like to read it, since it is fairly short, and thereby present a position for our discussion, if that is all right.

Mr. ROGERS. You may proceed.

Dr. FYE. Thank you, Congressman Rogers.

Mr. Chairman and Gentlemen: It is a great privilege and a real pleasure to appear before the committee once again and express my views and opinions on the Report of the Commission on Marine Science. I come before you as president and director of the Woods Hole Oceanographic Institution, as a member of the National Academy of Sciences Committee on Oceanography and as president of the Marine Technology Society, a professional society composed of about 5,000 scientists, engineers, and related professions all of whom are vitally interested in the wise utilization of the oceans. However, in my testimony I speak only as an individual who is greatly concerned about the position of the United States in regard to its activities in the oceans.

The aptly titled report of the Commission, "Our Nation and the Sea," is the most comprehensive document ever prepared on the stake of the United States in the oceans. As soon as the Commission's report was released in January, a group of our senior personnel at Woods Hole undertook a detailed study of the report both to inform ourselves and to evaluate the impact on our institution and on oceanography in the United States in general. The report is a magnificent job, and we commend it to the administration and the Congress for evaluation and action. I am here to offer what modest assistance I can in your evaluation, but we do look to you for ultimate action and implementation of a majority of the programs.

The Commission has provided a much needed evaluation of the importance of marine activities in terms of other high priority goals of the Nation. As we see it, this report places the importance of the oceans to the Nation on the same general level of concern as outer space, public health, foreign aid, transportation, and urban problems. We would underscore this importance and endorse the Commission's evaluation.

We scientists, however, are not unmindful of the fact that science is merely a part of an intricate mosaic of the national life and does not comprise the whole picture. Our daily lives are immersed in the engrossing pursuit of greater understanding of the enormously complex marine environment, and we often experience frustration in the conviction that our efforts and results are woefully inadequate when compared to the vast potential held by the seas.

However, we know full well that marine science and ocean development are vital national concerns only to the extent that there is a wise

division of our resources between immediate national problems and the longer range opportunities offered by the oceans. Responsible scientists seek no more, and the Nation deserves no less.

Developing the Nation's seas can only be accomplished properly through a truly national effort. It is important for us to recognize this point and distinguish between the recommendations of the Commission for a national program and the interpretation in some quarters that this proposal is a Federal program.

We at Woods Hole see this distinction clearly and suggest that others who may have misinterpreted this basic premise take a closer look at the Commission's report. "Our Nation and the Sea" is appropriately subtitled "A Plan for National Action" calling for a cooperative effort by private enterprise, the individual States, the academic community, and the Federal Government. This cooperation will be an essential element for a national effort.

The report of the Commission which considers both science (understanding the oceans) and engineering (doing things in the oceans) is much too comprehensive and far-reaching to comment on each recommendation. However, we do strongly support the main thrust of the report and regard it as highly urgent that steps for implementation of its key recommendations be taken by the administration and by the Congress.

Many of the recommendations, if adopted, will in one way or another profoundly affect the Woods Hole Oceanographic Institution and influence the programs and policies of all ocean activities in the United States. We do not endorse every proposal in the report but we support the purpose of the Commission's recommendations and the general direction in which they are attempting to move the ocean sciences.

In particular, I would like to comment on specific proposals and recommendations in the report which are intimately related to the purposes, policies, and objectives of Woods Hole and ocean science in general, and which in turn determine the course of many future programs for the years ahead. Some of this influence is, in fact, already being felt.

My own institution, the Woods Hole Oceanographic Institution, is likely to be affected most dramatically if the Commission's recommendation to establish three or four major university-national laboratories is adopted. We are most interested in the implications of this concept and in all its interrelated facets including: The basis for selection or establishment of the laboratories; funding programs to provide long-term financial stability; academic and professional freedom to pursue basic investigations; and cooperative programs of national and international scope.

In order to place these relationships in proper perspective and to present our views on the proposal for a University-National Laboratory, I would like to remind you of some of the philosophy which has guided the Woods Hole Oceanographic Institution for the four decades of its existence.

The institution was founded in 1930 in accordance with the recommendations of the first Committee on Oceanography of the National Academy of Sciences. That committee recommended the establishment of a "single, well-equipped oceanographic institution in a central loca-

tion on theAtlantic Coast * * * to supply necessary facilities for research and education * * * and to encourage the establishment of oceanography as a university subject."

Dr. Henry B. Bigelow served as the secretary of that first committee on oceanography and had a great deal to do with the shaping of its recommendations. He was subsequently asked to become the founding director of the new institution, and for the next 10 years gave it his daily guidance.

A strong interdisciplinary staff was built up at Woods Hole under his direction, and major oceanographic research studies were undertaken. At the same time, cooperative studies were undertaken with faculty members and graduate students from many other universities. The major oceanographic research facilities that were available in Woods Hole were thus made available to the oceanographic community at large, and friendly advice from the permanent Woods Hole staff helped to increase the probability of experimental success by these other scientists and students.

A large endowment grant from the Rockefeller Foundation enabled the institution to be financially self-sufficient for the first decade of its life. The demands of the war effort in the early 1940's, however, drastically affected the operation of the institution. Increased research in the oceans was essential, and the institution accepted Federal funds to undertake special problems of particular importance to the Navy.

Since that time, the institution has had to rely more and more on Federal grants and contracts to maintain its position as a leading center for oceanographic studies, and today more than 90 percent of our annual operating costs are met with Federal funds.

The basic philosophy from the beginning has prevailed—a strong, interdisciplinary permanent staff; major and sophisticated facilities for studying the oceans; and extensive arrangements for cooperative studies with faculty and students from other universities. Thus the institution has been operating in fact, though not in name, much as a University-National Laboratory.

In answer to a question from the Commission a year ago, I suggested that we needed a variety of types of laboratories in the United States concerned with ocean studies. Some should be matched in size and complexity with the problems to be investigated in the oceans. Many important problems are at least as large and complex as an entire ocean basin and can only be solved by teams of scientists and engineers involving many disciplines and talents using highly sophisticated research tools such as research ships and specialized computers.

Consequently, some of the oceanographic laboratories must also be large and complex enough to tackle these problems. Some of these will be involved in obtaining a better fundamental understanding of ocean phenomena and with basic problems about life in the sea. These should be the University-National Laboratories; funded on a continuing stable framework and given a great deal of freedom in planning programs.

I therefore strongly support the Commission's recommendation for the establishment of University-National Laboratories and feel it appropriate to name the Woods Hole Oceanographic Institution as a primary candidate for this proposal.

In the context of the Commission's report which stresses our national capability in the sea, it would, in my opinion, be unthinkable and untenable to support a program of basic research in marine science through the University-National Laboratories without also supporting a program for fundamental technology. Marine science and fundamental technology are inseparable.

Except for certain applications in specific areas of exploitation, notably the petroleum industry, really new developments in fundamental marine technology have been relatively limited. Great strides have been made in oil exploration, desalination techniques, and design and development of deep submersibles where economic return supported the research.

I do not intend in any way to demean these laudable efforts of private industry; I congratulate them on their progress and urge them forward to explore these and other areas of marine technology. Industry is motivated by profit—we must recognize this economic principle of free enterprise—and we must encourage it because our existence depends on it.

However, despite some success in applied marine technology advances in fundamental technology have been slow and fragmented. Materials research and instrumentation, both cited as major areas of concern by the Commission, must be given considerable and consistent support as a part of a successful technological program. Basic science and basic technology must move ahead together, or perhaps not at all. New theories in science demand exploration and proof—new technologies permit this exploration and can provide the proof. In many cases, new or improved techniques invite new applications which will lead researchers to unexpected knowledge and results.

With the strong convictions which equal my support of the recommendations regarding University-National Laboratories, I urge that the Commission's recommendations to initiate a dynamic and comprehensive fundamental technology program be accepted and implemented.

The Commission has also recommended that a new agency be set up to oversee the Federal Government's civilian activities in the oceans. This is of particular importance for the implementation of a national program to improve our fundamental technology in the oceans.

The establishment of an independent agency which reports directly to the President and, more importantly, answers to a unified ocean activities committee in each House of Congress, is the most important recommendation in the entire report.

The proposed National Oceanographic and Atmospheric Agency, if established as recommended, would include 55,000 employees, 320 seagoing ships, and 38 laboratories. The Federal Government's and the Nation's ocean activities would be clearly visible to the public and the reasons for these activities would be clear and would receive a continuing place in our national priorities. Some may say this is too big an agency—but the ocean problems are gigantic. Others may quibble with the composition, and I, in fact, did propose to the Commission over a year ago another plan for an ocean agency.

However, the important overriding point is that a new composite civilian agency is essential to the healthy growth of the Nation's ocean

activities and to the implementation of a national program. In my opinion the Nation's interests will be well served by the establishment of NOAA.

I also endorse the Commission's recommendation for the establishment of a National Advisory Committee for the Oceans as a useful method of obtaining support and advice on the program as it develops. This advisory committee is of vital importance in its own right and is not a substitute for the agency or other key Commission recommendations.

The Stratton Commission report may well be the most important single document concerning the oceans in our lifetime. The report has charted a national course which, if followed, can insure that the oceans will benefit all mankind for generations to come through the leadership of the United States.

The Commission has provided a marine sciences blueprint which is scaled to the total Nation-building plans of the future. Congress and the President have been presented with an opportunity to establish a permanent and stable place for oceanography in the list of national priorities.

The report has given us a national sense of direction which—if implemented by the Federal Government—now can enable us to launch a new decade of accomplishment in the oceans—a new era which will see the world begin using the oceans widely and productively and in peace. Now, I believe, is the moment to take the initiative. The world will not stand by while nations hold each other at bay on a sea of food and mineral resources for which there is a growing need.

Thank you, Mr. Chairman.

Mr. Downing (presiding). Thank you, Dr. Fye, for a very fine statement.

Doctor, you make the statement that basic science and basic technology must move ahead together or perhaps not at all. I wonder if you could elaborate on that a little bit, particularly basic technology.

Dr. Fye. It seems to me, sir, that these are interlinked and interwoven in a very intimate way. It is certainly true that we must learn something about the facts of the oceans before we begin to do things in a major way, which is what technology is all about; but I think today the time is ripe for developing both.

We have had five or 10 decades of exploring the oceans and learning something about them. We know a great deal about the oceans. There is a great deal we don't know, but I think we are now ready to begin major projects in the oceans. This will require the development of a capability for doing things in the oceans and thus approach the day when we will be making use of the oceans in a very major way.

So, as I see it, in the days ahead the development of a fundamental technology may be even more important than the research activities which I normally represent with my Woods Hole hat on. This will be the way in which the United States can stake its claim in the oceans in an effective and imaginative way.

Mr. Downing. Could you give us an example of fundamental technology?

Dr. Fye. I think there are a number of examples that we could take from the recent past. If I may, I would like to take an example from Woods House because I know those best.

Seven years ago it was decided that it would be wise to have a small submersible of considerably more mobility than the *Trieste* to go down and take people down in the ocean for exploring it. Out of this concept, with Navy support and the important backing of my distinguished colleague this morning, funds were made available and the little submersible *Alvin* was built. Fundamental technology was involved in building such a submarine.

There was some research involved, but in a very minor way. Once this tool was available to us, then it became, as I indicated in my first point, an important tool for research.

This I think does illustrate the interweaving of technology and research and how both depend one on the other and both are important to each other.

There are many other examples of technology. You get into the fishing business. Most of this is development of engineering techniques, and technology.

Mr. DOWNING. Thank you.

Mr. Mosher?

Mr. MOSHER. Mr. Chairman, it seems to me that Dr. Fye's statement is very encouraging and very useful, particularly useful to us in helping our understanding of what we face, and his emphasis on the sorting out of priorities for us is important.

I like the way he starts his statement and ends it. On the top of page 2 he suggests that he and the other experts that are before us can offer us assistance but that it is up to us on the committee to give the ultimate action and implementation, and on the final pages of his report he says that now is the moment to take the initiative, and I certainly agree with that sense of urgency.

Dr. Fye, in discussing the history of your own institution and the important reliance your institution has had on Federal support, I am wondering what portion of the Federal grants and contracts you have had have dealt specifically with military and defense matters as distinguished from so-called civilian uses of the ocean.

Dr. FYE. Mr. Mosher, the ratio between military applications and desire to learn more about the oceans for civilian uses has varied over the years and, as you well know, these are intermixed. One finds something that may be useful to the Navy today and tomorrow will be of interest in civilian uses.

When I became Director of the Woods Hole Oceanographic Institution in 1958 our best estimate was that about a third of the work was classified and thereby tagged as of direct application to the Navy.

Around 65 to 70 percent of the work was supported by the Navy, primarily from ONR. That ratio has shifted for many other reasons over these last 11 years.

Our classified work is down very considerably. The estimate today would be 3 to 5 percent. The support by the Navy has increased but not in proportion to the total increase in our operating budget so that the support from the Navy now is about half the total support.

Some of the types of work which were classified 10 years ago are no longer classified. We look at the oceans as an interesting, complex system about which we must learn everything we can within our capability. We believe very strongly that this knowledge will be of impor-

tance both in terms of our defense effort and in terms of the civilian uses of the sea. So we don't distinguish uniquely unless it has some rather specific application. And as I indicated, there has been a shift over the last decade.

I feel it is important for a laboratory like ours to continue in both military and civilian aspects of work. I personally believe we should continue to be a strong supporter of the Navy requirements. At the same time we should concern ourselves more and more in the days ahead with the peaceful applications of the uses of the sea.

Mr. MOSHER. I have interpreted the congressional interest which was represented in the act we adopted in 1966, which created the Commission and the Council, as emphasizing the need for a much greater impetus and effort in the civilian aspects of ocean sciences and engineering.

I assume we would accurately interpret the Stratton report, the thrust of it, where it recommends the creation of these new laboratories and the support of this laboratory effort, as being a new emphasis on the civilian uses of the ocean and giving that a higher priority and emphasizing the need and the demand and the opportunity in those areas.

Would you agree with that?

Dr. FYE. Yes, Mr. Congressman. I would certainly accept your interpretation of what the Commission has done. I think the only additional comment I might make is that in my opinion it is not so much a shift of priorities as it is a natural evolution from science to engineering and technology—the capability of learning, to the capability of doing. As I assess our progression in oceanography, we have now reached a point where it is logical to turn toward engineering and technology and do more of the projects, such as are outlined in the report.

I would hesitate to say that these national projects are put at a higher priority than the defense requirements. I think they are of comparable importance. I hope in my own institution that we can continue to emphasize both.

As the engineering activities expand in the next decade, and I am confident they will, and I think this is the main thrust of the Commission's report. We may find ourselves doing a larger ratio of work applicable to civilian uses as compared with Navy applications, but only because we have done so little of this before.

So that in a way ocean engineering is just coming into its own, as I see it.

Mr. MOSHER. I am sure you are right. It seems to me historically that it is more difficult to get support for some of the Nation's civilian needs and therefore a new emphasis is needed.

I have one other question. Mr. Chairman, if I may.

Dr. Fye, on page 3 you say: "We do not endorse every proposal in the report."

Do you want to give us an example or two of the type of proposals in the report that you do not endorse?

Dr. FYE. These are relative matters, Mr. Mosher. I don't have any list of affirmatives and negatives out of the report. I think it is more a matter of emphasis. I think in general the report has been beautifully done and is a magnificent job. I would prefer not to isolate out

minor points of disagreement because I just don't think I have analyzed it in that sense.

Mr. MOSHER. Counsel reminds me of the proposal for a nuclear powerplant on the mid-Atlantic Ridge. Do you want to react to that proposal?

Dr. FYE. Yes, I would be very happy to react to that, Mr. Congressman.

Mr. MOSHER. Are we both punning when we talk about reacting?

Dr. FYE. I think it is the kind of project which will be done in the years ahead. I think it can be done engineeringwise. It has some attractive possibilities. If we don't do it, someone else will, and I think the question of pollution and safety can be adequately taken care of. We have done the more difficult job of adequately taking care of it on land, and I think the Continental Shelf nuclear plant will in many ways be simpler.

Mr. MOSHER. That is all.

Mr. DOWNING. Mr. Karth?

Mr. KARTH. Thank you, Mr. Chairman.

Last week, Dr. Fye, Captain Bauer appeared before this committee and made a very strong recommendation that instead of creating a NOAA, we place the total responsibility in the Department of the Interior.

I would like for you to list a number of reasons why you feel that would not be as good a recommendation as the one made by the Commission and why it might not serve the best interests of oceanography, oceanology, or marine sciences as the NOAA approach which was recommended by the Commission.

Dr. FYE. Mr. Congressman, I am always reluctant to testify on matters of Government organization when I am before such a distinguished group of experts, but I would be happy to give you my reactions if they are taken in the proper context.

I have read Captain Bauer's testimony, and I don't agree with it. I have told him that, as we came in the door this morning.

Let me first say, if I may just for the record, that there are many ways of getting at this problem of organization. It can be done in any one of a number of existing departments. It can be done with a new agency. It can even be done with the present organization.

So what we are really talking about is efficiency and what is the optimum organization.

I do believe the Commission's proposal of a NOAA, or at least some form of an independent agency, will be better than giving any existing department the prime assignment in ocean activities. I think it will be difficult within an existing department to give the ocean the high priority that it needs. More subtly than that, I think the Interior Department is oriented more toward land activities and what is needed is a new kind of a vision that is oriented seaward.

I wouldn't for a minute suggest that Interior can't do it or Transportation or Commerce. I am sure they all could.

It is a question of whether, in my opinion, they would do it as well. Frankly, I think it would be done better by an independent agency.

Mr. KARTH. Thank you very much.

Thank you, Mr. Chairman.

Mr. DOWNING. Mr. Pelly.

Mr. PELLY. Mr. Chairman, I don't have any questions.

I would like to thank Dr. Fye for his contribution. We are going to need a lot of support, I can tell you, before we ever get this thing through.

I was just thinking, as to your answer to the question with regard to transferring this responsibility to the Department of the Interior, that we would have one department with us if we did that. As it is, I think we are going to have them all against us. So we will have to overcome a great deal of jealousy and prejudice and desire for empire building. If we have support of eminent people like yourself, I think it will encourage us to go ahead, and I hope succeed, in overcoming some obviously very strong obstacles.

Thank you.

Mr. DOWNING. Mr. Hanna.

Mr. HANNA. Thank you, Mr. Chairman.

Dr. Fye, I want to join with the gentlemen who have evaluated your presentation here in such a favorable manner.

I wanted to follow up on what Mr. Mosher had said. It has appeared to me that there is conflict of mentality that we have to deal with in this new program we are going to try to undertake. I think there has characteristically been a mentality of protecting what is, expanding what is going on, and evaluating on a basis of competition and incompatibilities, and as a result, we approach things on an adversary basis.

As against that I think we would like to encourage a mentality of realization of what can be and encouragement of discovery of what is not and an evaluation on a basis of cooperation and interdependency which can give us a little less of the adversary approach. How do you react to that?

Dr. FYE. I react very favorably to that, Congressman Hanna. I know that the problem of reorganization which the Commission report presents to you is the most difficult of all. It is going to take a lot of study and, as you say, it will take a great deal of cooperative effort and positive thinking.

In fact, I think it only comes into proper perspective if we think of the really magnificent and gigantic offerings that we see from the oceans. We must not be totally land oriented in this world of ours. It is almost three-quarters water. So we have to think progressively as you say. I am very confident that this will be done. I react very positively to your comment.

Mr. HANNA. Of course, in facing the reality as it now exists, I think that the flow of money comes easier if you can show the protective influence. That is why the Navy is going to dominate and have dominated because it is the essence of the protective mentality. We may be taking the tougher course.

It isn't going to be as easy to sell to the people as protection, but I think that with the support we can get from people like yourself and others who have as deep experience in this field as you have certainly had, that maybe we can steer that more difficult course.

But I personally believe that as we are going to set up a new type of agency and orient it toward this second mentality, we had better hesitate to pick up the knife until we are sure we can cut the mustard.

Thank you, Mr. Chairman.

Dr. FYE. May I comment on that, Mr. Chairman?

Mr. DOWNING. Yes, indeed.

Dr. FYE. I certainly agree with you, sir, and I have often wondered how our small organization, and we are a small organization at Woods Hole, can help.

I think probably the place we can help most is in trying to assist in the education of people so that this narrow mentality that you describe won't be self-limiting. I think it is very important, and I would like to offer our assistance in this very important phase. Without this kind of education, I think it is quite impossible to expect to take this forward step.

Mr. HANNA. I appreciate the gentleman's recognizing that educational requirement because I think it is one of the paramount requirements of this whole operation.

Mr. DOWNING. Mr. Keith.

Mr. KEITH. Thank you, Mr. Chairman.

I am sorry, Dr. Fye, that I couldn't be here this morning. This is my third subcommittee meeting, and I am sure that similar busy schedules account for the absence of so many of my colleagues. We really have very good attendance here this morning, considering the pressure of business.

I would like to comment on the dialog which has just taken place here and ask, if I might, are we not talking about mental attitude versus mentality?

Mr. HANNA. We are talking about mental attitude. I think that is clear from what we said.

Mr. KEITH. You mentioned with reference to the nuclear powerplant on the Continental Shelf that we have solved the problems on land. How about those on shore, where water is used either for a cooling process or to disperse an effluent? Have we solved those with reference to nuclear powerplants on the shoreline?

Dr. FYE. Certainly not in all locations, Mr. Congressman. Each location is a different problem, as you know from your own district where there is one now under construction.

I was very interested in a recent visit to Maine where Governor Curtis had called a number of people to advise in this regard to find that they were looking toward the possibility of using the heat output of a powerplant as a benefit. With the very cold water along that part of the coast they wanted to heat up a whole lagoon and see what they could do with warmer water species.

I think this represents a proper attitude toward the whole pollution problem. Whenever we can make the inevitable waste products of civilization a benefit to us we should do so. Many times we can, if we are ingenious.

I do believe that if nuclear plants are properly located along the shore or even under the water of the Continental Shelf, that we can minimize any disadvantages and in many cases make it a benefit to the local community.

Mr. MOSHER. Will the gentleman yield?

Mr. KEITH. I yield.

Mr. MOSHER. I had a conversation recently with some British scientists in which they reported to me their positive efforts in using the heat from these power sources to the advantage of aquaculture, to the creating of a very useful climate in the water.

I think there are lots of possibilities for turning deficits into benefits in these situations.

Mr. KEITH. I thank you and Dr. Fye for those observations. It is a subject of great interest in my district, where we have both a fossil fuel plant and a nuclear plant onshore, and occasionally I get correspondence with reference to the side effects these plants produce.

Speaking of pollutants, we were advised recently in a memorandum that the Woods Hole and other oceanographic authorities had more or less sanctioned the disposal of chemical and biological warfare refuse as currently carried out off our Continental Shelf. Would you care to comment on that, Dr. Fye?

Dr. FYE. Yes, Mr. Keith. I did have the opportunity yesterday afternoon, after you informed me of the position stated in that memorandum, to explore what had happened within my institution. There has been no institutional support of that idea. One of our senior scientists, Mr. Fuglister, participated in a group of experts in advising the Army on the matter. I talked with him at length since he had been there and had heard the full story.

I would not be prepared to pass judgment on the wisdom of disposing of this material at sea provided it is done in a reasonable location. We do recognize that the oceans are our biggest and in many ways our best dumping ground. It is quite properly a question of where the waste material eventually shows up.

The important thing we must be sure to undertake in any such situation is to research the total problem adequately so that an optimum location can be chosen. There are places in the oceans where things can be buried where the currents are low, the upwelling of water is low, the overturning from bottom to top is low, and where dissipation can occur within a time that is sufficient to make this an appropriate thing to do.

Actually Mr. Fuglister told me that he was not very comfortable about the location that is proposed. In his opinion they are a little too close to the Continental Shelf, too close to the Gulf Stream and the fishing grounds. They happen to be about 50 miles from the particular location off the edge of the stream we call station D. We have been instrumenting that particular spot of the deep ocean for 4 or 5 years.

On the other hand, he said he couldn't find anything really overly hazardous about that, providing everything worked the way the plan said it would.

My position on this would be, first of all, that disposal in the ocean can be done successfully provided there has been proper study of the problem. With proper investigation a suitable location can be chosen. I would not have an opinion on the particular location that is proposed at the moment off New Jersey. I don't have the chemical information available concerning the hydrolysis of these particular gases into essentially safe byproducts.

Mr. KEITH. It would seem to me that this is a very good argument for the creation of such an agency as we are discussing this morning. I think this proposed agency would be the proper authorithy to look at the plan, give its approval, and suggest locations that might be best. It could regulate the circumstances under which it was done, and catalog what has gone into the oceans in these various locations. It is another reason for us, it seems to me, to look with favor on the establishment of NOAA.

Thank you, Mr. Chairman.

Mr. DOWNING. Mr. Grover.

Mr. GROVER. I have no questions.

Mr. DOWNING. Mr. Jones?

Mr. JONES. I have no questions.

Mr. DOWNING. Counsel would like to ask you some questions, Doctor.

Mr. DREWRY. Dr. Fye, I think I understand your modesty in discussing the Government organization. I don't think you should really feel so humble about it because you have probably been associated with the development of this program as long as almost anybody else, you and the distinguished gentleman behind you, Dr. Wakelin.

In your statement you made no comment on the National Advisory Committee for the Oceans, NACO. Would you care to comment on your views in relation to that?

Dr. FYE. The statement, Mr. Drewry, about that was rather short. It is on page 9. May I expand on that? I did say that I endorsed the concept of NACO and I do so very strongly. I think this is one of the examples of the great wisdom of the Commission in that they have proposed to establish a major advisory board which may well turn out to be as important as NACA was years ago in aviation. Thereby the Government can secure the advice of outstanding people who will continuously monitor this program.

Their advice then could be available to the Congress, to the executive branch, as well as to NOAA, itself.

I read the report to indicate that the Advisory Committee for the Oceans would go beyond just the program of NOAA, but would look at the total national effort. I think this would be an important adjunct to the establishment of an independent agency.

I would, as I say, not feel that this was a sufficient step forward in lieu of NOAA, but I think it is one that should be a companion step to the establishment of NOAA, and I would be very unhappy if the agency were established without such an advisory board.

Mr. DREWRY. And I take it from what you are saying that you feel that they should be established simultaneously rather than to create NACO maybe first and then later get around to NOAA?

Dr. FYE. I would prefer, Mr. Drewry, if this could be done either essentially simultaneously as a part of the same legislative act or to have NACO follow NOAA shortly thereafter.

As to whether it could be a first step, with some modification: If we find that the difficult step which Mr. Hanna discussed of getting everybody educated enough to follow along seems to be impossible, I think that this could be a first step.

However, if it were, I would then hope that the Congress would go beyond what is in the Commission report relative to the advisory committee. I would hope then to follow somewhat more closely what was done in the early days of NACA and permit the committee not to be solely advisory but to have it become a funding body to a certain extent as a part of this first step.

I don't believe, very frankly, that that would be nearly as good as following what the Commission has outlined. I would not exclude it, however. That would be better than nothing, and it could be, I think, quite an effective step if a modification of NACO were put in at the time it was established.

Have I made myself clear?

Mr. DREWRY. Yes, you have, and I think in an important contributory way.

You mentioned that so much of your work has been for the Navy, much of it has been classified, and after a while much of it becomes declassified. Do you in your position at Woods Hole take any initiative, in saying to the Navy about something that was classified when it was started or carried out, "Look, it is time to declassify this project"?

Of course, the Navy is excluded from NOAA. Yet, obviously, there has to be a working relationship between what the Navy is doing and what the civilian side is doing, and you at Woods Hole and other similar institutions are certainly in the position where they could advise the Department of Defense that it is time to let this get out into the public domain, that is an important work but the reasons for classification are no longer valid and therefore let it go.

Dr. FYE. Yes; certainly as the originator of a great deal of data which has been classified, we are in an appropriate position to take such action, and we do. I indicated earlier a shift in the total amount of classified work from 10 years ago. Then maybe a third of the total work was classified, now about one-tenth of that or 3 percent is classified.

I should expand on that to indicate that this is largely due to the fact that the Navy no longer finds that it is necessary to classify much of the oceanographic data that formerly was classified. This circumstance gives us a very legitimate basis for suggesting declassification.

This change in policy, which I think has been a very wise one, has expedited the whole study of the oceans. All of oceanography has been helped by this. In large measure, the policy change took place when Dr. Wakelin was Assistant Secretary of the Navy, and I give him a great deal of credit for this. I think it has resulted in a much better total integration of what the Navy is supporting together with what the civilian agencies are supporting.

Mr. DREWRY. I wonder if I could ask you to comment on what has happened to the submersible leasing program. I guess right at the moment Woods Hole is not in the market for any of that work, but I understand that the submersible leasing program has been drastically cut back within the Department of Defense. I don't remember the figure, but I am told that as many as 1,600 requests are pending for use of the various submersibles which are in being, on which I believe private industry has spent at least $100 million to develop, like the *Star* 3 and so on.

Would you mind commenting on how you view that cutback as to the effect it might have on a forward program or encouraging this fundamental technology that you were speaking of earlier?

Dr. FYE. Mr. Drewry, I don't have any up-to-date information about the cutback in the chartering program for submersibles. I think it is a good program. I think the idea of doing this is great. Industry did go a long way to stick its neck out and made a major contribution through the submersibles, and I think we should use them.

We had occasion last fall to charter the *Dowb* from General Motors in our search for *Alvin*. We only made one dive because of the weather, but we are very familiar with the submersibles that have been built in

industry. We were very fortunate in having *Alvin* up to October 16, last year for our own work. We intend to go back and retrieve *Alvin* from the edge of the Continental Shelf.

So, at the moment, we would have some case for chartering submersibles. We expect to obtain a new one which is now under construction at Electric Boat.

I think it is a sound program and should be expedited. I don't have the current information on the cutback.

Mr. DREWRY. I apologize for asking the question because I realize, of course, that you have been out of the country for the last month or more I guess.

Dr. FYE. Three weeks.

Mr. HANNA. Mr. Chairman, before the witness leaves, might I ask if it would be possible for you, doctor, to provide for the committee a copy of the proposal you made to the Commission over a year ago for a certain plan for an ocean agency?

Dr. FYE. Mr. Congressman, I happen to have with me, as the saying goes, a synopsis of that statement. The reason I didn't put it into the record in my statement is that I believe the Commission's proposed organization has had a great deal more study than mine. The 15 men were brilliantly selected, and the job they did was superb.

I would be glad to have this in this record if you wish. It does propose an independent agency for the purpose of ocean engineering and resource development. It does not propose as comprehensive a takeover, as it were, from all the other departments. My own actual opinion is that it would be a good scheme, but the Commission has suggested a better one.

Mr. HANNA. I think it would be helpful to have it as part of the genesis of coming to a plan, plus there may be some alternatives for solving some of the inevitable problems that will turn up.

Mr. DOWNING. We might like it even better.

Without objection, we will place your synopsis in the record at this point.

(The synopsis follows:)

[From MTS-Memo, Marine Technology Society, January 1968]

A FEDERAL ORGANIZATION FOR OCEAN ENGINEERING

The time has come for this country to push forward with a major ocean engineering program. This program should complement present oceanographic research, but should have different objectives requiring different techniques. Two cogent reasons for such a program are the need to conquer the ocean depths for peaceful purposes, and the need to develop the oceans' vast resource potential.

The present National Oceanographic Program includes some ocean engineering projects, but the goal of many is to improve the capability for basic and applied research programs. Although the departments and agencies involved in the national program undertake engineering projects to fulfill their missions in the oceans, there are gaps that preclude the development of a comprehensive ocean engineering capability. These gaps must be filled if we are to exploit the oceans effectively.

Industry cannot undertake projects of sufficient magnitude *soon* enough to match the nation's total requirements. The cost of these projects will be large and the profits may be slow in realization. Often the results may be too diffuse to be exploited by a single industry. We cannot expect industry, unaided by the Government, to undertake necessary research and engineering studies, to fund construction of a system, and to underwrite its operation, unless a satisfactory return

can be realized on the investment. Private industry undoubtedly will undertake ocean engineering projects as soon as it is economically feasible. I do not believe this will come about soon enough to satisfy national needs and to meet national goals.

Oceanographic research and engineering programs now underway are germane to the operations of sponsoring departments and agencies. However, the development of a vastly increased ocean engineering capability probably cannot be split satisfactorily among these many organizations. I think there should be a *new government organization* whose primary responsibility is *ocean engineering* and *resource development*. This organization should work outside and beyond the missions of existing agencies. Today we are establishing new national oceanic goals. There is new work to be done. To meet these needs, it is reasonable to establish a new agency with a different mission.

It would not be wise to sweep all ocean-related activities into this proposed agency. It is wholly proper to retain defense-related activities within Navy, environmental missions with ESSA, basic research with NSF, fisheries research with BCF, regulation of the merchant fleet with Maritime Administration, and the study of nuclear energy with AEC.

The new agency should have two prime functions: (1) to develop ocean engineering and to exploit ocean resources within a defined mission, and (2) to coordinate marine-oriented work of existing agencies through a marine sciences board similar to the National Science Board or the former NACA. It should be a funding, not an operating agency. It should use appropriate existing government laboratories, private industry, university and non-profit institutions to accomplish its mission.

The expenditure of public funds must be substantially increased, probably to a few billion dollars annually, to insure that the United States maintains its position of leadership in marine affairs. Within our governmental system, this can be done by establishing appropriate committees in Congress which would sponsor the proposed new agency. There is ample precedent for such action when a national need is critical.

Mr. Downing. Did you have any supporting papers that you would like to put in the record along with the synopsis?

Dr. Fye. I think it is adequate. I have a fuller statement than just the synopsis. If the committee wishes, I would be glad to send that to you. I think this covers the essential part of the idea.

Mr. Downing. I think it might be well to include that along with the synopsis at this point in the record.

Without objection that will be done.

(The statement follows:)

Woods Hole Oceanographic Institution,
Woods Hole, Massachusetts, *June 13, 1969.*

Hon. Alton S. Lennon,
Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, House of Representatives, Washington, D.C.

My Dear Congressman Lennon: During the hearing of your Subcommittee on May 20th, I was asked to submit to you my statement before the Research and Environmental Panels of the Commission on Marine Science, Engineering and Resources on November 7, 1967 concerning Government organization. The text of this material is enclosed.

Also, I was asked to submit comments concerning the management of the proposed University-National Laboratory and the Coastal Zone Laboratory. As I noted in my statement before your Subcommittee, our staff in Woods Hole has had this particular aspect of the Marine Commission Report under detailed study. We are putting together for our Board of Trustees our concept of how a cooperative program such as a University-National Laboratory might be operated in Woods Hole. When this is completed and reviewed by our Board, I would be glad to submit this for your information.

In general, I believe the management concepts set forth by the Commission are sound in that a major responsibility for the University-National Laboratory would rest with the university concerned. In the case of the Coastal Zone Laboratory, they propose a close affiliation between the State and Federal agencies supporting these laboratories. I hope our further studies in Woods Hole will be useful to you.

It was, as always, a pleasure to appear before your Committee.

Sincerely yours,

PAUL M. FYE.

ON ORGANIZATION WITHIN THE FEDERAL GOVERNMENT FOR MARINE ACTIVITIES—

A Statement before the Research and Environmental Panels of the Commission on Marine Science, Engineering and Resources on November 7, 1967

The question of adequate institutional and organizational arrangements for prosecuting the national program in oceanography has been raised. A consideration of these arrangements follows logically a discussion of major programs which should be supported by Federal funds and a case for some governmental reorganization can be made on the basis of conducting such programs in an efficient manner. For example, there is a need for a strengthening of the coordination function previously carried out by the Interagency Committee on Oceanography. The case for re-organization is even stronger, however, when one considers the necessity of an increased comprehensive program which will lead to the full utilization of information about the oceans for the benefit of mankind. I think the time has come when this country should push forward with an ocean engineering program. In some ways, it will complement the present oceanographic research program, but an ocean engineering program really has quite different objectives and will require different techniques for achieving them.

There are many reasons why we should have an ocean engineering program. Two of the most cogent, to my mind, are the need to conquer the ocean depths for peaceful purposes and the need to develop the vast resource potential of the oceans. You and your colleagues are all keenly aware of the many arguments why this country should embark on an ocean engineering program, and I shall not reiterate all of them here, but I do believe that the case in favor of an ocean engineering program can be defended solely on the basis of these two goals.

We are aware that you are exploring the question of Federal support of engineering developments in the oceans as compared with the possibility of this being done primarily by private industry. It appears clear to us that private industry cannot be expected to undertake a program of sufficient magnitude soon enough to match the nation's total requirements. The initial cost of these engineering projects in the oceans will be large and the profits almost surely will be slow in realization. Too often the results of ocean engineering may be too diffuse to be exploitable by a single industry. We cannot expect an industrial enterprise, unaided by the Government, to undertake the necessary research and engineering studies, to fund construction of a system, and to underwrite its operation unless a satisfactory return can be realized on the investment. A good example of the area wherein the expenditure of public rather than private funds is indicated is the possibility of improving the fishing grounds by controlled returning of nutrients to the surface waters. No single company can be expected to undertake this type of project. There is no doubt in my mind that private indstry will undertake ocean engineering projects when it is economically feasible to do so. I do not believe this will come about early enough to satisfy the national needs and to meet national goals.

The present National Oceanographic Program includes some ocean engineering projects, but the goal of most of them is to improve the capability for carrying out basic research programs. An example close at hand is the Navy-sponsored development of our deep research vehicle, ALVIN. This project has necessarily entailed a great deal of ocean engineering, but the objective has been to provide a vehicle for oceanographers to use in their basis research projects.

Although the several departments and agencies involved in the National Program undertake ocean engineering projects in order to fulfill their mission in

the oceans, there are gaps between their present missions that preclude the development of a comprehensive ocean engineering capability. These gaps must be filled if we are to develop the capability of conquering the ocean depths for peaceful purposes and exploiting the vast resource potential of the oceans.

There are many ways in which these gaps in present ocean engineering projects could be filled. I think it is fairly obvious that the oceanographic research and engineering programs now underway are indeed germane to the operations of the departments and agencies sponsoring them. It is not nearly so clear to me that the development of an ocean engineering capability can be satisfactorily split up among many organizations. I tend, therefore, to think that there should be a new Government organization whose primary responsibility is ocean engineering and resource development.

This new Government organization should fill the void outside and beyond the mission of existing agencies. Today we must establish new national goals concerning the oceans. There is new and different work to be done. To meet these new needs, it is reasonable to establish a new agency with a different mission—a mission, I would suggest, that should be carefully drafted by this Commission.

I do not believe it would be wise to sweep all ocean-related activities into this proposed new agency. It is wholly proper and wise to retain the defense-related activities within the Navy, to continue the environmental mission of ESSA, basic research in the oceans with NSF, fisheries research with BCF, regulation of the merchant fleet with the Maritime Administration and the study of the interactions within the ocean environment of man's use of nuclear energy with the AEC.

In my opinion, the new agency should have two prime functions: (1) The development of ocean engineering and the exploitation of ocean resources within a mission defined by the Commission, and (2) the coordination of the marine-oriented work of existing agencies through the establishment of a marine sciences board somewhat similar to the National Science Board or the Former National Advisory Committee for Aeronautics. It should be a funding agency and not an operating agency. To accomplish its mission, it should use Government laboratories, private industry, university and non-profit institutions as is appropriate.

It appears likely that the expenditure of public funds must be substantially increased to insure that the United States maintains its position of leadership in marine affairs. Probably the expenditure of a few billion dollars annually will be necessary. Within our governmental system, this can best be done by the establishment of appropriate committees in both houses of Congress which will be the sponsoring committees for the proposed new agency. There is ample precedent for such action when a national need is sufficiently critical.

Mr. Downing. Doctor, do you think the time will ever come when we will be able to harness the power of the oceans as we now do our rivers?

Dr. Fye. Not in exactly the same way, Mr. Chairman, but in very important and effective ways. I am not sure what is in your mind when you say as we have done with the rivers, perhaps with hydraulic plants and electric power.

As you know, there have been a number of schemes of developing electrical power from tides. One apparently is working successfully. I have no doubt that others could be devised, and it could well be a successful operation from an engineering standpoint.

The economics have really been what has been holding it back. From other standpoints, there are many ways that one can think of for using the energy of the oceans. This includes the supply of food which is a source of energy, derived eventually from the sun through the photosynthetic process.

I would answer your question by saying that I don't think it will be in ways completely analogous to the rivers, but certainly equally and even more importantly in its effectiveness.

Mr. Downing. Thank you, Dr. Fye.

One more question from Counsel.

Mr. DREWRY. Dr. Fye, this synopsis is on the letterhead of the Marine Technology Society. Is this a position of the Marine Technology Society or is this just your own position or just Woods Hole?

Dr. FYE. No; Mr. Chairman and Mr. Counsel. That was published as a part, as you see there, of the MTS Notes, not because I was president-elect, but because they thought they would like to publish it. It was the only convenient copy. I can send you, of course, the full text which will be on a Woods Hole heading. It is by no means the position of the society. It did spark some very interesting and I think important discussions within the society, but it is entirely my own personal writing.

Mr. DREWRY. I thought that point should be cleared up on the record.

Thank you.

Mr. DOWNING. Thank you, Dr. Fye. You have made a very important contribution.

We have another distinguished witness with us this morning, Dr. James H. Wakelin, Jr., chairman, the Oceanic Foundation. Honolulu; the Research Analysis Corp., McLean, Va., and member of the advisory board of the Ryan Aeronautical Co., San Diego, Calif.

Dr. Wakelin was the former Assistant Secretary of the Navy for Research and Development.

(Biography of Dr. Wakelin follows:)

DR. JAMES H. WAKELIN, JR., PHYSICIST, WASHINGTON, D.C.

Born, Holyoke, Massachusetts, May 6, 1911.

A.B., Dartmouth College, 1932; B.A., Cambridge University, 1934; M.A. 1939; Ph. D., Yale University, 1940.

Senior Physicist, B. F. Goodrich Company, Akron, Ohio, 1939–43.

Lt. and Ledr., USNR, Office of the Coordinator of Research and Development, and Office of Research and Inventions, Navy Department, Washington, D.C., 1943–46.

Director of Research, Engineering Research Associates, Inc., Washington, D.C., 1946–48 (now Univac. Div., Sperry Rand Corp.).

Associate Director and Director of Research, Textile Research Institute, Princeton, N.J., 1948–54; Research Associate 1954–59.

Founding Director and Vice President, Chesapeake Instrument Corp., Shadyside, Maryland, 1954–59.

Consultant on the Planning and Organization of Research and Development, General Electric Company, Stanford Research Institute, American Radiator and Standard Sanitary Corporation, J. P. Stevens and other companies, 1954–59.

Assistant Secretary of the Navy (Research and Development), 1959–64; Chairman, Interagency Committee on Oceanography, 1960–64; Head, U.S. Delegation to Intergovernmental Conference on Oceanography, Copenhagen, 1960, and to Intergovernmental Oceanographic Commission, UNESCO, Paris, 1961.

Chairman, Board of Trustees, Research Analysis Corporation, McLean, Virginia (1965–__).

Chairman of the Board, Oceanic Foundation, Honolulu, Hawaii (1966–__).

Consultant and Member Advisory Board, Ryan Aeronautical Company, San Diego, California (1964–__).

Consultant, United Aircraft Corp., East Hartford, Conn. (1967–__).

Member, Naval Research Advisory Committee, Department of the Navy; Board of Trustees, Committee for Research and Exploration, National Geographic Society; Board of Overseers, Chairman (1967–__), Thayer School of Engineering, Dartmouth College; Overseers' Committee to Visit the Department of Astronomy, Harvard University; Executive Committee, Graduate School Association, Alumni Board, Yale University; Member of the Corporation, Woods Hole Oceanographic Institution.

Honorary Member, National Security Industrial Association and Marine Technology Society (President 1966–1968).

Member, American Physical Society, The Fiber Society, Rheology Society, Textile Research Institute, Society for Computing Machinery, Sigma XI, Gamma Alpha, Zeta Psi.

Distinguished Public Service Awards, Navy 1961 and 1964.

Author Scientific Papers on Textile and High Polymer Research, and Co-author with C. B. Tompkins and W. W. Stifler, Jr., of "High Speed Computing Devices"—McGraw-Hill Book Co., New York (1950).

STATEMENT OF DR. JAMES H. WAKELIN, JR., CHAIRMAN, THE OCEANIC FOUNDATION, HONOLULU; THE RESEARCH ANALYSIS CORP., McLEAN, VA., MEMBER OF THE ADVISORY BOARD OF THE RYAN AERONAUTICAL CO., SAN DIEGO, CALIF., AND FORMER ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH AND DEVELOPMENT

Dr. WAKELIN. Thank you, Mr. Chairman.

I have before me a statement. Is it your pleasure that I should read it, sir?

Mr. DOWNING. Yes, proceed in any way you want, Doctor.

Dr. WAKELIN. If I may, I would rather quickly read it, and then reply to your questions.

Mr. Chairman and members of this subcommittee, it is a privilege for me to appear before your committee to discuss the report of the Commission on Marine Science, Engineering and Resources entitled, as Dr. Fye has said appropriately, "Our Nation and the Sea," which was submitted to the President in January of this year.

I should like to consider (1) the growth of our ocean program during the years 1960–66, (2) national policy and the guidelines under which the Commission conducted its work, (3) the national program recommended by the Commission, and finally (4) the organizational framework recommended by the Commission to implement the program it has recommended for our national effort in the oceans.

In the years prior to the enactment of Public Law 89–454, establishing the National Council on Marine Resources and Engineering Development, and the Commission on Marine Science, Engineering and Resources, the planning and budgeting of the Federal program in the oceans was coordinated by the Interagency Committee on Oceanography of the Federal Council on Science and Technology.

This period includes the years 1960–66. I was privileged to be the first chairman of the ICO from 1960–64, and in that capacity I have appeared at numerous hearings before your committee on the substantive and programing matters as well as the fiscal matters concerned with the Federal program. During this period, the Federal annual funding for our ocean efforts increased from $55 million in 1960 to $123 million in 1964.

I might say, Mr. Chairman, that a more dramatic group of figures would include the years 1958 and 1959, with budgets of $21.3 million and $35.8 million, respectively. After the issuance of the National Academy's report in 1959 on the ocean program, there was a decided impetus given between to the funding of the Federal program.

At that level of Federal support, the coordinating mechanism of the ICO appeared to be sufficient to guide the program.

I might also say that there were 22 agencies, bureaus, and offices reporting to 30 committees in the Congress, both in the House and Senate, involved in the ICO.

At the present time, in 1969, the Federal funding for our ocean program stands at $471.5 million, with $528 million planned for fiscal year 1970.

Under Public Law 89–454, the National Council on Marine Resources and Engineering Development assumed the coordinating role previously undertaken by the ICO, with the Vice President as chairman, and members comprising Cabinet officers. The Council has done an outstanding job of keeping the program moving, and in initiating action in new fields of activities requiring urgent, timely, and immediate attention.

Public Law 89–454 of June 17, 1966, established the national policy with reference to the oceans as follows:

SEC. 2. (a) It is hereby declared to be the policy of the United States to develop, encourage, and maintain a coordinated, comprehensive, and long-range national program in marine science for the benefit of mankind to assist in protection of health and property, enhancement of commerce, transportation, and national security, rehabilitation of our commercial fisheries, and increased utilization of these and other resources.

The law defines "marine science" as follows, in section 8:

SEC. 8. For the purposes of this act the term "marine science" shall be deemed to apply to oceanographic and scientific endeavors and disciplines, and engineering and technology in and with relation to the marine environment; and the term "marine environment" shall be deemed to include (a) the oceans, (b) the Continental Shelf of the United States, (c) the Great Lakes, (d) seabed and subsoil of the submarine areas adjacent to the coasts of the United States to the depth of 200 meters, or beyond that limit, to where the depths of the superjacent waters admit of the exploitation of the natural resources of such areas, (e) the seabed and subsoil of similar submarine areas adjacent to the coasts of islands which comprise U.S. territory, and (f) the resources thereof.

The Commission on Marine Science, Engineering and Resources was instructed to review and analyze the current programs in the marine environment and "to recommend an adequate national marine science program that will meet the present and future national needs without duplication of effort" * * * together with, and finally the most important, "a governmental organizational plan with estimated costs."

The program recommended by the Commission encompasses a broad effort in the oceans, including, strong Navy and strong civilian participation. The Commission cites the need for scientific and engineering knowledge in order to provide the basis for making decisions on alternative courses of action with reference to the resources of the seas, and emphasizes the requirement for a strong civil marine technology program.

It recommends the establishment of university-national laboratories to undertake global and regional programs, coastal zone laboratories and a general expansion of the Navy's oceanographic effort in order for our Nation to increase our understanding of the planetary oceans.

In marine technology, the Commission recommends a significantly increased capability to utilize the Continental Shelf and the Continental Slope down to a depth of 2,000 feet, and to explore the depths

of the oceans to 20,000 feet by 1980, and to utilize these depths by the year 2000. A series of national projects to implement this program is recommended.

In recognizing the increasing importance of our coast land, the Commission recommends the establishment of coastal zone authorities to provide for Federal, State, and local machinery to preserve the quality of these regions, to develop the coastal areas for offshore terminals, storage facilities, et cetera, to increase the opportunity for recreation and public access to the water, and to strengthen our efforts in pollution control.

In the field of marine resources, the Commission has recommended changes in national and international policies and law with respect to the living and mineral resources, and suggested mechanisms by which Government and industry can cooperate to develop means by which private investment can utilize ocean resources in an economical manner.

The Commission further recognizes that the utilization of the oceans and ocean resources in terms of our domestic economy is primarily the domain of private enterprise.

Many of the changes suggested by the Commission define the manner in which the Federal Government and the States can contribute to the private sector by providing information and data in technology, engineering, and resource evaluation.

While the United States has immediate interests in the coastal zone, effective use of this area requires a broader understanding of ocean processes on a global scale. The Commission recommends programs in research and exploration, monitoring and prediction, environmental modification and international areas in order to provide an improved understanding and prediction capability of the oceans and atmosphere on a global basis.

All of the foregoing recommendations require many services which can be provided principally by the Federal Government. These supporting services of a technical and operational nature include mapping and charting, navigation, safety, and policing, data management, and instrument calibration and standards.

The scope of the program recommended by the Commission to advance our interest in and use of the seas demands a significant increase in the annual funding for such a program. In fact, the Commission recommends an increase of about 160 percent in our annual ocean program funding. Specifically, it recommends an addition of $800 million beyond the roughly $500 million now annually appropriated for the present program.

It is, then, reasonable, for an annual expenditure of $1.3 billion, that we consider the value expected from such a program, and that we think very seriously about whether a program of such magnitude can be administered, managed, and directed by the part-time effort of Government officials who have primary responsibilities in many other important areas.

Further, it is necessary to ask ourselves whether the sum of the work representing that in support of the roles and missions of presently organized executive departments is sufficient to include all of the necessary functions of an enlarged, forward-looking national program in the oceans.

In its review and analysis of the present ocean effort, and the future program which it has recommended in its report to the President, the Commission recommends as a management structure the establishment of a major civilian agency, the National Oceanic and Atmospheric Agency, reporting directly to the President.

The primary mission of this agency is to implement the programs that the Commission has recommended for our national effort, specifically:

To explore the marine frontier and its interrelationships with the atmosphere;
To define its resources;
To advance capabilities for its use;
To provide supporting services, including weather and ocean forecasts;
To minimize conflicts over uses of the marine environment;
To coordinate scientific and technical requirements and recommendations in support of foreign policy objectives; and
To serve marine industry and the marine interests of the American people.

The Commission also recommends, in order to coordinate the interests of the Federal Government, the States and regions, industry and the academic community, the establishment of the National Advisory Committee for the Oceans, comprising 15 members with backgrounds in and responsibilities representing the above interests.

Finally, the Commission recommends the need for the Congress to organize its committee structure so that greater focus can be given to the entire program in marine activities.

At this point in my statement it is probably unnecessary but I should like to remind your committee that recommendations for the integration and improved management of our national program in the oceans have previously been made by several important groups.

In June 1966, the Panel on Oceanography of the President's Science Advisory Committee, under the chairmanship of Dr. Gordon J. F. MacDonald, recommended, "a major reorganization of non-Navy governmental activities in oceanography. The recommended reorganization would place in a single agency all those Federal activities related to description, prediction, and attempts to develop capabilities of modifying the environment (ocean, atmosphere, and solid earth), and those activities concerned with managing and developing resources of the ocean."

Also, in 1966, the Committee on Oceanography of the National Academy of Sciences, National Research Council, under the chairmanship of Dr. Milner B. Schaefer, in its report entitled "Oceanography 1966," had this to say about the national program:

. . . We still have no national ocean program with which to implement the policy—

and no national ocean budget with which to fund it. National needs now require that we build the managerial structure needed to develop these instruments. Considerable coordination of managerial function in both executive and legislative branches of the Government will be necessary before these forward steps can be taken.

The position of certain industrial leaders in this matter is reflected by a group in the National Security Industrial Association, under the chairmanship of Mr. John H. Clotworthy, in a March 1964, publication entitled "A National Ocean Program."

This group proposed that a National Ocean Science and Technology Agency be created to guide and coordinate a truly national program.

From these earlier studies and analyses, it is abundantly evident that eminent Americans representing the President's Science Advisory Committee, the National Academy of Sciences, National Research Council, and the industrial community, have recognized the need for expanding our ocean efforts into a national ocean program, and for the appropriate organizational structure to implement, manage, and effectively direct this program.

The Commission on Marine Science, Engineering, and Resources under the leadership of its distinguished chairman, Dr. Julius A. Stratton, has performed an outstanding service of enduring value to the United States.

The principal report of the Commission is an excellent summary of the technical, operational, and management plans for a national ocean program.

The reports of the Panels, forming the basis for the plans and recommendations of the report, contain valuable, detailed information on (1) basic science, (2) environmental monitoring, (3) management of the coastal zone, (4) manpower, education, and training, (5) industry and private investment, (6) marine engineering and technology, (7) marine resources, and (8) international legal-political frameworks.

I concur in and support the recommendations of the Commission in regard to the national ocean program and the organizational structure to implement it.

There is no doubt that a unified managerial framework such as NOAA must be established if we are to pursue the recommended program.

There is also no doubt that, to obtain the advice and counsel of the States, regions, industry, and the academic community, we require the establishment of the National Advisory Committee for the Oceans. This will provide the needed coupling of these interests with the Federal effort, and will accelerate the transfer of the results of this effort into methods, techniques, and procedures useful to the private sector and the domestic economy.

The extent and the success of our national ocean program will play a vital role in the security and the economy of our country, and on its influence in the community of nations. The program will also contribute in a most significant manner to the supply of increasing quantities of food and other resources from the sea for the common good of all mankind.

A program of this magnitude and importance should not be managed in the executive branch or reviewed in the legislative branch in a fragmented manner. I suggest that the National Oceanic and Atmospheric Agency, and the National Advisory Committee for the Oceans be established in recognition of the importance of our national ocean program to the United States.

I also suggest that the Congress take the necessary organizational steps to provide for the integrated legislative and appropriational review of the program.

Thank you, Mr. Chairman, for the privilege of appearing before your committee and for the opportunity to present my views on the

report of the Commission on Marine Science, Engineering, and Resources.

Mr. LENNON (presiding). The committee, Dr. Wakelin, is very grateful to you for your interesting, informative, and challenging statement.

The gentleman from Ohio, Mr. Mosher.

Mr. MOSHER. Well, Mr. Chairman, I don't think I have any questions, but I must say that such complete support for the Stratton Commission's recommendations from a man of the very distinguished experience and success of Dr. Wakelin in practical operations in this field is very encouraging and very significant. I welcome it.

Mr. LENNON. Thank you, sir. With that I totally agree.

The gentleman from Florida.

Mr. ROGERS. Thank you very much.

I share those feelings. It is good to see Dr. Wakelin before this committee again.

Dr. WAKELIN. Thank you, Mr. Rogers.

Mr. ROGERS. I might say that really it was your idea that I used in introducing legislation to bring about the Commission, which was later adopted by this committee and by the Congress.

I think it has done an excellent job, and am delighted to see that you feel that its findings are worthy of support. I agree with you.

I would like to have your views, and you may not have them ready to give to us in this regard right now, so that you may submit them to the record, or at least I would be interested in having a copy of your views, as well as those of Dr. Fye, on the operation of coastal laboratories, which the Commission discusses, and the operation of such laboratories, how they should function, as well as the national laboratories which Dr. Fye mentioned in his testimony, because I think it is essential for us now to begin to crystalize our thinking on how the regional and coastal laboratories would work in relationship to the national laboratory, and where their administration should be placed.

Perhaps you could submit something at a later time.

Dr. WAKELIN. Mr. Rogers, if I may, I would like to do that. I don't have any direct views on the management or establishment or interrelationships of such laboratories for the coastal zone right now.

Mr. ROGERS. I understand. Thank you so much.

Thank you, Mr. Chairman.

(The document follows:)

COASTAL ZONE LABORATORIES AND UNIVERSITY NATIONAL LABORATORIES, BY DR. JAMES H. WAKELIN, JR.

I would like to endorse the Commission's recommendations for the creation of University National Laboratories and Coastal Zone Laboratories. While there has been some confusion in the marine community about how these two recommendations relates to each other and to Sea Grant Colleges, I believe that examination of the Commission's other recommendations and the reports of the Panels clarify the relationships quite adequately.

UNIVERSITY NATIONAL LABORATORIES

The concept of the University National Laboratories was based on two principal factors: (1) Some elements of marine science have now become what may be called "big science," which means that large and expensive facilities are needed. These facilities include ships, aircraft, working platforms, arrays of buoys, special equipment, and deep submersibles. Further, the facilities may have

to be marshalled all at once for a given investigation of a priority ocean area. The Commission's recommendation, quite logically, was based on a limited number of groupings of such facilities because of the capital investment required. Such groupings already exist, but need to be expanded. The Nation's great oceanographic laboratories, Scripps, Wood Hole, and Lamont, already have the nuclei on which to build. And so do a few other institutions.

(2) The kind of "big science" research conducted by the University National Laboratories cannot be turned off and on by minor changes in fiscal priorities. This is what happens when the laboratories must depend on project-type funding. Under such uncertain funding it is difficult to maintain the necessary staffs, with guarantee of tenure, and it is difficult to plan operations in support of research. Under the concept of the University National Laboratory, block funding would be provided to support the core facilities and operations. Such block funding would enable the laboratories to plan and conduct oceanic research at the level the Commission proposes, and which the national interest requires. The block funding, with a statement of intent to fund annually, could be supplemented with specific project grants by the mission-oriented agencies for the conduct of programs important to their missions. Further the University National Laboratories would not be for the exclusive use of the managing university but would provide facilities for investigators from other institutions, both inland and coastal.

In summary, the two principal elements for the University National Laboratories are adequate facilities in a few places to conduct "big" ocean science, and block funding to assure the maintenance of facilities and staff.

It is also important to note that the laboratories would operate primarily offshore. Their objective would be to gain understanding of the ocean environment—its physical characteristics, its chemistry, its biology, and its interactions with sun, air, and land. The research would be basic in nature.

The Commission's recommendation was that the funding of the University National Laboratories be assigned to the new agency, NOAA. This may be desirable within the context of the new agency's mission as the Congress legislates it, but it is also unnecessary. In other words, we need not wait for a new agency to institute a University National Laboratory program. Both the National Science Foundation and the Office of Naval Research have such block funding programs. Either agency could manage the University National Laboratory program quite as well as could a new agency. In fact, the new agency would have to lean on the experience—and perhaps recruit the actual personnel—of NSF and ONR. The Commission itself pointed out that NCAR, the National Center for Atmospheric Research, now administered by NSF, is the atmospheric equivalent of the oceanic University National Laboratories. The management by Scripps, under NSF funding, of the deep ocean drilling program, is equivalent to operations proposed for the University National Laboratories. In fact, because the operations would be for research into the natural phenomena of the seas, I can see merit in leaving basic research and the laboratory operation where it now resides. Certainly the nation must have more ocean scientific research as an underpinning to all its ocean goals, but I think the principal need is in ocean technology and engineering.

COASTAL ZONE LABORATORIES

The concept of the Coastal Zone Laboratories was to ensure the availability of science and engineering necessary for the use, maintenance, and improvement of the Coastal Zone. The coastal zone and the high seas do merge, and there are some common problems, but most of the problems are quite different. It is in the coastal area that man's activities have the greatest impact and where there is the greatest conflict among users. The Coastal Zone Laboratories would provide the information on which management decisions of a real and practical nature would be based at the appropriate level of government. And the Laboratories would also devise the best means of carrying out such decisions with due regard to maintenance or restoration of the environment, conservation, and the public interest.

The Commission recommended assignment of responsibility for the Coastal Zone Laboratories to the National Sea Grant Program. I think the reasons are apparent. Sea Grant, which has concentrated initially on coastal zone resources, already has funded institutions to carry out research identical to that envisaged for the Coasal Zone Laboratories. I know the committee is aware that Sea Grant

funds have been too limited to make a major impact, but even with a tight budget the program has managed to initiate programs which are, in fact though not in name, Coastal Zone Laboratory activities. For example, Louisiana State University's Sea Grant Program is directed to the management and utilization of the great coastal marshes. The University of Delaware's Sea Grant Program is to apply systems engineering principals to the Delaware River Estuary and the Coast. The University of Washington's Sea Grant Program includes a project involving economists, lawyers, oceanographers and biologists to determine the best management and utilization of an area within Puget Sound.

Such activities need to be expanded, and provision must also be made for facilities, which are at present restricted under the terms of the Sea Grant Act, but the Congress could make this change quite easily.

SEA GRANT COLLEGES

The purpose underlying Sea Grant Institutional Support, which will eventually lead to designation of Sea Grant Colleges, was to assist qualified universities to develop broadly based marine competence which can be applied to problems and opportunities of the region served by the institution. This concept goes far beyond either the University National Laboratory concept, or the Coastal Zone Laboratory concept, but can include both as a legitimate part of a Sea Grant College function. I believe the Coastal Zone Laboratory idea should be included within the Sea Grant mission, with legislative changes as necessary for implementation. I do not believe it would be as appropriate for Sea Grant to include the University National Laboratories because the objectives are not entirely consistent. Where Sea Grant has the purpose of developing marine resources and the people to conduct such development, the University National Laboratories are for more basic research. I suggest that the University National Laboratories could be more appropriately conducted by other parts of the National Science Foundation.

There is no reason why a major university with the necessary breadth and competence could not be designated both a Sea Grant Institution and a University National Laboratory. In general, the two programs would be conducted and administered by different groups within a given university, and any overlap would be of mutual benefit without altering the distinct character of the two kinds of effort.

I may also say that there is no need to label activities with exclusive tags. If a Sea Grant College has the necessary programs to meet Coastal Zone Laboratory requirements, there is no need to give it a different name. It's the function that is important, not the title.

CONCEPTS OF MANAGEMENT AND COORDINATION

The plans outlined in Chapter 3 of the Commission's Report, "Our Nation and the Sea," deal specifically with the relation of the Federal, State and regional interests in the management of the three types of laboratories under the administration of the National Oceanic and Atmospheric Agency. It is perhaps in order to expand on these relationships and to give my personal views on the matter of planning and coordination of the programs of each of these types of laboratories. In a program as broad as that recommended by NOAA, the development of program plans and program coordination is of the utmost importance in achieving an integrated program working toward the national goals of our ocean effort.

First, there must be adequate coordination of the plans and programs of the University-National Laboratories, the Coastal Zone Laboratories, and the Federal Laboratories which come under the direct administration of NOAA. For example, the University-National Laboratories, in undertaking regional programs, should have close working relationships with the Coastal Zone Laboratories operating in their regions, and with those Federal Laboratories where their coastal and global interests are mutual. Also, the University-National Laboratories must work together in programs of common interests where their global expeditions and exploratory programs are planned to operate in the same areas of the deep sea. In Chapter 3 of the Commission's Report, I believe it is clear that the programs of the University-National Laboratories would be administered in the Federal Government by NOAA, and those of the Coastal Zone Laboratories by programs mutually agreed upon between NOAA and the Coastal Zone authorities. Finally, the programs of the Federal Laboratories under NOAA's jurisdiction

would be administered by that agency but with mutual coupling with the Coastal Zone and University-National Laboratory programs. While the recommendations of the Commission are clear and follow well developed guidelines for the management of the Coastal Zone, plans for programs in this area must also include those of the University-National Laboratories and the Federal Laboratories. In order to coordinate these efforts, I suggest that the head of NOAA establish a deputy position whose responsibility, together with his staff, would be the Planning and Coordination of NOAA Programs.

The second area of coordination and program planning includes that of the laboratories and operating elements of NOAA with other Government agencies such as the Navy, Army, Maritime Administration, Interior, AEC, NASA, the Smithsonian, etc., whose roles and missions include responsibilities for ocean science and engineering. This I would suggest should be the responsibility of a deputy and his staff for Coordination of Interagency Programs.

The third element of coordination involves the Federal, State and regional programs in coordination with the efforts of industry working in ocean areas important to and in support of the national program. Without the proper coupling with industry, as the technology of ocean operations develops, the knowledge developed by the Federal and State groups will not properly be transferred to industry, nor will industry be able to contribute its part in support of the development of these programs. This is an area of great importance, and should be the responsibility of a deputy and staff, for Coordination of Industrial Programs.

Finally, all of the capabilities developed by Federal, State, regional, industrial and academic developments will be important in our ability to cooperate with other countries in mutually valuable efforts in internationally sponsored programs. Important in this area is a strong and closely associated planning effort with that of the Department of State and with the Department of the Navy. I suggest that this effort be the responsibility of a deputy for Planning and Coordination of International Programs.

Each of the above deputies for plans and program coordination, and their staffs, should work closely with the National Advisory Committee for the Oceans so that the interests of the Federal, State, regional, industrial and academic communities can be welded together into a truly national program. It may be desirable to establish a Council of Laboratory Directors to advise NOAA on their recommendations, plans and programs, and who will assist in the coordination of the national ocean program, as well as participation by the United States in internationally sponsored programs. In this regard the National Advisory Committee for the Oceans assumes a most important role in advising, assisting and guiding the head of NOAA in many areas of science, technology and engineering, both in the U.S. programs and those in international cooperation. Through NACO the interests of Federal, State, regional, industrial and academic efforts will be combined into an integral program.

Mr. LENNON. Thank you, sir.

Mr. Pelly.

Mr. PELLY. Mr. Chairman, I would like to mention the contribution that Dr. Wakelin made in pulling together a lot of the agencies when he was in the Navy Department. I don't think we would have arrived at the point today of having before us this gigantic proposal had it not been for the fact that you were able to pull everybody together, and even after you left I think your influence lingered on, because there is and has been ever since you were active in this Government work a recognition I think by the various agencies that they would work together.

I was interested in your statement that Congress should also reorganize, and I wonder how much thought you have given that. It is a very complex problem.

Dr. WAKELIN. Yes, sir. I am not an authority on the organization of the legislative and appropriational branch, here, but I would hope that the problems that we faced when I was Chairman of the ICO

would not be repeated with the establishment of a central agency to undertake the civil program for marine sciences, and I say this very feelingly, Mr. Pelly.

As I pointed out, there were 22 different offices or bureaus, including those of the departments which were concerned with the work of the ICO during my Chairmanship, and we did report to 30 different committees in the House and Senate.

We found only one committee that would look at the whole program, and this is your committee here.

I want to say again, as I did in 1964, almost 5 years ago this month, when I was about to leave the Navy, that I think one of the great influences on ICO as an integral structure was the interest of this particular committee in the work of the ICO.

While I went before Mr. Mahon's committee on naval appropriations, including the oceanographic work in support of anti-submarine warfare and also basic science, there was no other committee than this that looked at the whole program, including Interior, Commerce, Navy, and other agencies that contributed to the work of the ICO.

I would hope that this committee would take the lead in the House in the matter of jurisdiction with respect to this subject. I think the interest of the members of this committee, their sincerity, and the hard work that they have done in preparing themselves for the hearings in which I was involved indicate that they have a principal interest and a principal responsibility.

After all, the legislation for the Commission came out of Mr. Lennon's and Mr. Rogers' bill, and you deserve the credit for that.

We had certain ideas about the Commission's work, and I think it has been an outstanding job.

I would hope, however, that you could work out, Mr. Pelly, some method in this committee to take further interest in the integral structure in the House for such a program.

Mr. PELLY. We have had a reform bill before the House, which passed the Senate and went up to the Rules Committee, and is still there.

When you consider the problems that arise in trying to transfer jurisdiction from one committee to another, which is really from one individual to another, it is very difficult. It is something that has been worrying me.

I know that as far as this committee is concerned, we hope that we can carry forward with this, but we had a case not very long ago involving a problem of oil pollution on the west coast, and two committees vied with each other in their attempts to report legislation to carry out their ideas and establish their responsibility over population problems.

I can see that it is not going to be very easy. I know that there are men of great experience on some committees who feel that they don't want to give up the experience and interest that they have developed through the years.

When you say that Congress should reorganize, I know you are aware that those things do not come about so easily. It requires the exercise of statesmanship and skill by the leadership in Congress, and as much as anything else, the unselfish interest that comes from leaders

in your field coming before us and pointing up the importance of what we are now trying to accomplish. I think that this fact has to be impressed upon all Members of Congress, and I am sure it can be with people like yourself.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Pelly.

Mr. Jones.

Mr. JONES. Thank you, Mr. Chairman.

I have no questions, except to compliment the gentleman on his appearance here, and perhaps make a personal observation.

We are all aware of the dramatic success of the Apollo 10, and I think that vividly points out the need for a centralized, coordinated program in this field. I think with anything as fragmentized as the oceanography program, with 30 committees as well as departments and commissions, there would be no Apollo 10.

Dr. WAKELIN. I think that is right, Mr. Jones.

Mr. LENNON. Mr. Keith.

Mr. KEITH. Thank you, Mr. Chairman.

A comparison was made of the recommended National Advisory Committee on Oceanography with the National Advisory Committee for Aeronautics in 1915.

I recognize the problems of the executive branch in coming up with a reorganization that would implement the recommendations of the Commission, and of getting the public in the mood to respond favorably, either to that kind of Executive action or to congressional action along those lines. I wonder if you have any observation to make concerning the possible timing of the creation of NACO.

Dr. Fye commented briefly on this. Would you care to?

Dr. WAKELIN. Well, if I might, Mr. Keith, go back just a bit with respect to NACA, first the establishment of NACA was made possible through the Naval Appropriations Act, as you recall, in 1915, principally to establish an advisory committee to develop aviation both civilly and militarily in this country, to support the Navy and the Army, and to support the development of an industry that would contribute to our progress in aviation.

The National Advisory Committee on the Oceans, it seems to me, timewise, is somewhat beyond that stage in which we started in 1915 with the NACA.

I think we cannot have an NACO alone, unless we pattern it after the NACA with separate funding, the development of laboratories and test facilities and design studies, and engineering capabilities that would advance ocean science and engineering.

I think the problem is much bigger in this area than it was in the aviation industry for the purview that NACA had over it from 1915 into the 1920's. I think the timing of NACO ought to be simultaneous with NOAA.

I think if you set up an NACO as an advisory committee, the question I would ask myself is: Whom do they advise? Would they advise the Council? Would they advise the President? And if they have only an advisory capacity, it seems to me the power and effectiveness of an operating organization that could advise would be lost. There would be no implementation, except through the various departments, agencies, and offices that now conduct work in the oceans.

I think they should, that NOAA and NACO should be established simultaneously.

Mr. KEITH. I have no further questions.

I thank the witness for his comments.

Mr. LENNON. Mr. Hanna?

Mr. HANNA. Thank you, Mr. Chairman.

Dr. Wakelin, you have most recently been associated with one of the private companies involved in oceanography. Is it correct to assume that if we can demonstrate to industry that they have more to gain than they have to lose in terms oft heir own natural desires for activities that produce profits, that we could get their support in terms of this new agency setup?

Dr. WAKELIN. I don't think there is any doubt of that at all, Mr. Hanna.

Mr. HANNA. Because there is, of course, a natural predilection for people to be very conscious about what they have to lose, and you have to be very emphatic on what they have to gain, and I think that story has been told pretty well.

On the other hand, to get Government change, you have to use a different approach. It seems to me that in changing the agencies, you need a very firm position by the President and his immediate advisers. Do you feel that this administration is prepared to make a very firm stand in this regard?

Dr. WAKELIN. Well, I cannot speak for the administration. I think that, from what I know of their thinking on this, that they are still studying the whole proposition, and I think that they will have a Government position sometime in June.

Mr. HANNA. Do you agree with me that it would be very helpful if they come out with a strong position?

Dr. WAKELIN. I think it is almost imperative that they do; and, if such a move were made to consolidate some of the groups that are mentioned here in the report into an agency, it would have a profound influence on the questions that we have been discussing with Mr. Pelly. The Congress would then have to consider very seriously its role, and the mechanisms by which it could look at an integrated picture, both in the House and in the Senate.

Mr. HANNA. I should not like to be interpreted as being cynical, but it is my observation that if you can demonstrate a utilization of existing manpower in key spots in a manner which promises potential improvement in their power structure, and a positive expectation of increased funds, that this makes a second input to encourage restructuring of those agencies.

Would you agree with that?

Dr. WAKELIN. Yes, indeed. Yes, sir.

This could be done, of course, as the Environmental Science Services Administration in Commerce was set up by reorganizational administrative action of the President.

Mr. HANNA. I would think unless you could show that you were going to give consideration to those persons who have characteristically been carrying out duties, and who have built up experiences, that they might not come out and be against you, but you would never get anything done, and you would wonder why.

That would be my experience.

Dr. WAKELIN. Yes, sir.

Mr. HANNA. I think we have an entirely different problem, Mr. Chairman, in terms of the legislative change, because I think the legislative change comes from the result of pressure, and that is predicated on education, as Dr. Fye and I discussed as we exchanged ideas here, and I think that is general where persons like yourself and the organization within industry and the Academies and other areas must all join us in this educational process, because out of that will come the public pressure really required to make the legislative change.

Dr. WAKELIN. Yes, sir.

Mr. LENNON. Thank you, Mr. Hanna.

Immediately preceding Dr. Wakelin's statement, I ask unanimous consent that there be inserted in the record the biography of Dr. Wakelin.

Dr. Wakelin, I am particularly delighted that you were able and interested and concerned enough to make yourself available, because our association has been long over the years in relationship to the bringing into being of Public Law 89–454, from which we move today to consider the Commission's report.

I note that you state on page 6, about line 8, that, "In June 1966, the Panel on Oceanography of the President's Science Advisory Committee * * * recommended a major reorganization of non-Navy governmental activities in oceanography. * * *"

Is it your judgment that the Stratton report, or the Commission report suggests an implementation of its recommendations comparable to what was recommended in that particular panel report, that was headed up by Dr. Gordon J. F. McDonald, in general terms?

Dr. WAKELIN. Yes, Mr. Chairman.

I am just now looking at the report to which you referred, which is entitled "Effective Use of the Sea." It is not very different by way of organizational structure than that recommended by the Stratton Commission.

The reasons given in the report for the proposed reorganization are three: Unity of environmental sciences and observational technology; two, dependence of oceanic development for Navy and commerce on our ability to predict the environment; and three, clearly establishing responsibility for executing national objectives and nondefense missions for the oceans.

Mr. LENNON. In that same year, 1966, and you refer to it, also, on page 6, the Committee on Oceanography of the National Academy of Sciences-National Research Council, under the chairmanship of Dr. Milner B. Schaefer, made its report, and they specifically referred, according to your statement here, if I understand it, to Public Law 89–454.

I take it that in that particular report they made specific reference to the national ocean policy that was suggested or proclaimed by the enactment of Public Law 89–454. Is that your appraisal of Dr. Schaefer's report?

Dr. WAKELIN. That is my understanding, Mr. Chairman.

Mr. LENNON. I think you must keep in mind that while this particular act did attempt to establish by Congress a national oceanography or oceanographic program or policy, yet, at the same time, the act also provided for the creation of the national council that you and I have

discussed so many times in consideration of including it in that legislation. It also provided for the Commission, and the Congress attempted to mandate the Commission to recommend a Government structure if in the judgment of the Commission a Government structure was the best possible approach.

So I believe that actually the Stratton report, in a very strong way, picks up the two reports that you referred to in your statement, and follows through on them.

Now, I think we can all agree, and we have been an agreement over the years, with what you say on page 8, beginning on line 2, or more particularly on page 8, beginning at line 9, and I quote:

"A program of this magnitude and importance should not be managed in the executive branch or reviewed in the legislative branch in a fragmented manner."

Then you go on to say in that same paragraph:

I also suggest, and later on in your colloquy with two of the members you said you urged that the Congress take the necessary organizational steps to provide for the integrated legislative and appropriational review of the program.

And the gentleman from Washington commented on how easy it appears to so many people on the outside, but yet we recognize the turbulence that is created even in this committee by the agencies as suggested by NOAA.

You take the Coast Guard. This full committee has jurisdiction of the Coast Guard, but yet it is under another subcommittee. It brings in certain aspects of the Department of the Interior, the Bureau of Commercial Fisheries. Yet the legislative jurisdiction is under this full committee, but it is under another subcommittee chaired by another gentleman.

I would like to ask, were you furnished yet with a copy of Capt. Paul Bauer's statement before the committee of a few days ago?

Dr. WAKELIN. Yes, sir.

Mr. LENNON. Have you had an opportunity to study it, and review it at all?

Dr. WAKELIN. I have.

Mr. LENNON. I would appreciate it, sir, if you would furnish for the record your comments, either in concurrence or in opposition, or any position you would like to take about it. I would like to have your professional opinion, and when you read your biography you can understand how we value your opinion, on Captain Bauer's statement.

Captain Bauer served this committee for many years. We value his opinion.

Would you object to doing that?

Dr. WAKELIN. No, sir.

Mr. LENNON. We would appreciate it very much.

(The statement follows:)

DR. WAKELIN'S COMMENTS REGARDING CAPTAIN BAUER'S TESTIMONY

Captain Paul Bauer, in his testimony before this Committee, has proposed a Department of Environmental Sciences rather than the organizational structure of an independent agency, the National Oceanic and Atmospheric Agency, recommended by the Commission on Marine Science, Engineering and Resources. This is an interesting and far-reaching proposal beyond that which the Commission was directed to consider in Public Law 89–454, in particular Section 5(b) which

delineates the scope of the Commission's work in marine science and Section 8 which defines the term "marine science." While a Department of Environmental Sciences may eventually be established, I feel that the first step should be that of bringing together the ocean related civilian parts of the Executive Branch into an independent ocean oriented agency as recommended by the Commission. In this regard and in the matter of timing, I disagree with Captain Bauer's proposal and I urge that we get on now with the establishment of the National Oceanic and Atmospheric Agency and the National Advisory Committee for the Oceans.

Mr. LENNON. Are there any other questions?

I might say, Dr. Wakelin, that we are going to continue to hear the private sector at the laboratory level and the scientific level, and this will go on, I am sure, through the middle of June, before we can possibly reach any of the Government agencies which are involved in the Commission's recommendations.

We are going to take the liberty to call on you from time to time as we proceed.

In announcing the hearings for tomorrow, we have Dr. John Calhoun, Jr., Chairman of the Committee on Oceanography of the National Academy of Sciences, and Mr. Walter C. Beckman, president of Alpine Geophysical Associates, Inc.

That is the program scheduled for tomorrow.

With that, we thank you again, Dr. Wakelin, and the committee will stand in recess until tomorrow morning at 10 o'clock for continuation of this hearing.

(Whereupon, at 11:55 a.m., the subcommittee adjourned, to reconvene at 10 a.m., Wednesday, May 21, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

WEDNESDAY, MAY 21, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:10 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. The committee will resume the hearings this morning on the Commission report and all matters related thereto. We have a number of very distinguished witnesses appearing this morning, Dr. John C. Calhoun, the Chairman of the Committee on Oceanography of the National Academy of Sciences; Dr. Charles L. Drake, Lamont-Doherty Geological Observatory; Dr. Jeral J. Paulik, University of Washington; Dr. Donald W. Pritchard of the Johns Hopkins University; and Mr. Walter C. Beckman, president of the Alpine Geophysical Associates, Inc.

Mr. Counsel, do you know the order in which the witnesses wish to present their statements?

Mr. DREWRY. First the National Academy of Sciences Committee on Oceanography with Dr. Calhoun as the leadoff witness.

Mr. LENNON. I wonder, Dr. Calhoun and Dr. Paulik and Dr. Pritchard, if you gentlemen would occupy the seats at the table there, and it might expedite matters.

Are you going to make the single presentation, Dr. Calhoun, or will there be several presentations?

STATEMENT OF DR. JOHN C. CALHOUN, CHAIRMAN, COMMITTEE ON OCEANOGRAPHY, NATIONAL ACADEMY OF SCIENCES

Dr. CALHOUN. We have several statements. I would like each of these gentlemen to present his statement.

Mr. LENNON. You proceed and then introduce the speakers in the order that you prefer.

Dr. CALHOUN. Thank you, Mr. Chairman.

My name is John Calhoun, and I work for the Texas A. & M. University, College Station, Tex., as vice president for programs and director of the sea-grant program.

I am appearing here this morning as Chairman of the Committee on Oceanography, National Academy of Sciences, National Research Council, and, as you have already pointed out, there are several members of that committee here with me, and in addition, Mr. Vetter, our

Executive Secretary, is on hand to back us up with any information we might need to supply in the future.

Mr. LENNON. Without objection then, immediately preceding the statement about to be made by Dr. Calhoun, there will be inserted in the record a biography or carreer résumé.

(The career résumé follows:)

JOHN C. CALHOUN, JR.

Education: Pennsylvania State University—B.S. in Petroleum Engineering, 1937; M.S., 1941; Ph. D., 1946.

Employment (in reverse chronological order): Vice President for Programs and Distinguished Professor, Texas A&M University System, 1965– ; Director, Sea Grant Program, Texas A&M University, 1968– .

Assistant and Science Adviser to the Secretary of the Interior, 1963 to 1965 (on leave from the Texas A&M University System); also, Acting Director, Office of Water Resources Research, Department of Interior, July–December 1964.

Vice Chancellor for Development, Texas A&M University System, 1960 to 1963.

Vice President for Engineering, Texas A&M University System, 1957 to 1959.

Vice Chancellor for Engineering, Texas A&M University System, 1959 to 1960.

Dean of Engineering, Director of the Texas Engineering Experiment Station, and Director of the Texas Engineering Extension Service, Texas A&M University, 1955 to 1957.

Professor and Head of the Department of Petroleum and Natural Gas, Pennsylvania State University, 1950 to 1955.

Associate Professor, Professor, and Chairman of the School of Petroleum Engineering, University of Oklahoma, 1946 to 1950.

Research Assistant and Instructor, Pennsylvania State University, 1937 to 1946.

Professional societies: AIME, ASEE, Tau Beta Pi, Phi Kappa Phi, Sigma Xi, Society for the History of Technology, AAAS, American Society for Oceanography.

Publications: 84 technical and general articles; book, "Fundamentals of Reservoir Engineering."

Professional assignments: Present Trustee (1959–) and Chairman of Board (1968–), University Corporation for Atmospheric Research; Trustee, Texas A&M Research Foundation; Chairman, Committee on National Affairs, AIME; Committee on Mineral Science and Technology, NAS–NRC; Board of Directors, EDUCOM, 1966– ; Chairman, National Academy of Sciences Committee on Oceanography, 1967– ; Executive Director and President, Gulf Universities Research Corporation, 1966– ; Vice President, American Society for Engineering Education, 1968– .

Professional assignments: Past: Chairman, Council of Education of AIME; Chairman, Mineral Engineering Division of ASEE; Member, Engineering Committee on Interstate Oil Compact; Member, Education and Accreditation Committee, Engineers' Council for Professional Development (1955–1960); Vice Chairman, Engineering College Research Council; Chairman, Lamme Award Committee; ASEE; Distinguished Lecturer, Society of Petroleum Engineers, 1961; Member, Board of Directors, JETS, 1957–1964; President, Society of Petroleum Engineers of AIME, 1964; Member, Federal Council for Science and Technology, 1963–1965; Member Board of Directors and Executive Committee, AIME; Panel on Environmental Pollution, President's Science Advisory Committee, 1964–1966; Chairman, Department of Interior Committee on Marine Resources Program Development, 1966; Board of Directors and Executive Committee, Engineers' Council for Professional Development, 1964–1967; Chairman, Ad Hoc Panel on Scientific and Technical Communication Problems in the Husbandry of Domestic Resources, NAS/NAE, 1967; NSF Advisory Panel on Sea Grant Program (1967–1968).

Consulting: For private companies, state agencies, Federal agencies, and universities as petroleum engineer, petroleum production research specialist; science program and research manager, engineering educator and resource specialist.

Non-Professional Affiliations: Chairman, College Station United Fund, 1961; Member, Exchange Club, 1961–1963; Member, Board of Directors, Bryan Industrial Foundation, 1962–1963; Member, Cosmos Club, 1964– ; College Station Presbyterian Church.

Foreign Travel: Europe, Russian, Ceylon, Pakistan, Iran, Saudi Arabia, Egypt, Venezuela, and Japan.

Listed in: "Who's Who in Engineering," "American Men of Science," "Who's Who in American Education," "Who's Who in America."
Personal: Born Betula, Pennsylvania; Married Ruth E. Huston(Finleyville, Pennsylvania); Four children.
Present Address: 1106 Ashburn, College Station, Texas 77840.

Dr. CALHOUN. Thank you, sir.

I appreciate the opportunity to present my views on the implications of the report of the Commission on Marine Science, Engineering, and Resources to the future challenge presented to our Nation by uses of the oceans. The Committee on Oceanography of the National Academy of Sciences has studied and discussed the Commission report and we have agreed unanimously to endorse its scope and content as vital to the future of our Nation. We unanimously endorse the concept of a single agency as an essential element to meet national needs recognized by the Commission and we support certain specific recommendations of the Commission.

We formulated a letter which was sent to you under date of May 13, signed by myself as Chairman of the Committee on Oceanography, and with your permission, I would like to read that letter, which expresses the carefully considered views of the Committee on Oceanography.

Mr. LENNON. Doctor, as you may know, the staff has had instructions to insert that letter in the record, but now that you are going to read it, we withdraw the request. We will get it into the record anyhow.

Dr. CALHOUN. Preparatory to reading that letter and offering you any further statement, it might be well to note that the Committee on Oceanography is made up of individuals representing different scientific disciplines and different philosophies concerning the organization of ocean science. In a group such as this, it is not always possible to obtain unanimity of opinion, and when unanimity is expressed, it is more often with respect to generalities rather than about specific details.

Inasmuch as the report of the Commission on Marine Science, Engineering, and Resources covers a wide spectrum of ocean sciences and accompanying subjects and deals with economic, legal, and administrative matters, you can appreciate that the areas of consensus may be limited.

What I express to you today should be taken in this context of a committee point of view. In many cases, what I will be expressing is my best interpretation as Chairman as to those points on which I think the committee might agree. Several members of the committee who are here with me are prepared to give supplementary statements and to be available for specific questions, if you don't find that the Chairman is giving the opinions that you wish expressed in answer to your questions.

I should say that in no way do our remarks reflect a position of, nor should they be attributed to the National Academy of Sciences or the National Research Council.

As to the letter which we have placed on record, which is well thought out, addressed to the Honorable Alton Lennon, U.S. House of Representatives:

DEAR MR. LENNON: The Committee on Oceanography is pleased to respond to your letter of 1 April asking for our views on the recent Report of the Commission on Marine Science, Engineering and Resources. We have discussed the Commission's Report, "Our Nation and the Sea" extensively at our January and

March meetings. Our preliminary statement, based on these discussions, follows. As the Panel reports of the Commission become available, we will continue our review of the Commission Report and will look forward to the opportunity to comment in detail when public hearings are held by your Committee.

The Commission on Marine Science, Engineering and Resources has produced a milestone report. The Committee on Oceanography concurs in the Commission's conclusion that:

"How fully and wisely the United States uses the Sea in the decades ahead will affect profoundly its security, its economy, its ability to meet increasing demands for foods and raw materials, its position and influence in the world community and the quality of the environment in which its people live."

We applaud the recommended national marine program of the Commission as a major contribution and believe that national science needs will be well served by this program.

The single most important recommendation of the Commission is that the national marine program requires a major reorganization within the Federal Government, a point also stressed in our report "Oceanography 1966, Achievements and Opportunities." We believe that a single agency, or its equivalent, would provide the needed focal point for the development of capabilities that are essential to meet national needs recognized by the Commission. In our opinion many of the activities essential to an expanding program are unlikely to be adequately carried out in the framework of the shared agency responsibility.

Although the details of reorganization and the scope of activities for the proposed new agency will require much study and negotiation, we support the Commission recommendation that efforts in this direction proceed without delay. Furthermore, we urge the Congress to give early consideration to this proposal of the Commission.

As reorganization is discussed and as elements of the national marine program are considered in depth, many details and differences of opinion will need to be considered. The Committee on Oceanography recognizes the importance of continuing review and discussion, but strongly expresses the hope that such debate will not obscure the main thrust of the Commission's recommendations.

The program recommended by the Commission requires both an adequate technology and a firm scientific basis. In spite of the vigorous growth and development in the marine sciences and technology over the past few decades, the fact remains that our knowledge of the oceans and the factors that control its living and nonliving resources are just beyond the exploratory stage. Effective exploitation of the oceans' resources requires knowledge that can answer the fundamental questions of "where", "how", "why", and for certain resources "when". At present our ability to monitor the oceans is limited by technology, our hopes to improve the ocean environment as well as our ability to predict changes in the oceans is limited by the progress of science. To achieve capabilities beyond these limits our nation will require an organization and a program such as is recommended in the Commission Report.

Specifically, the Committee on Oceanography believes that the following major recommendations of the Commission will do much to accomplish these goals:

(1) Establish increased understanding of the planetary oceans as a major goal (page 23 of the Commission report).

(2) Establish university-national laboratories (page 27).

(3) Establish coastal zone laboratories (page 29).

(4) Initiate a comprehensive fundamental technology program (page 27).

(5) Establish national projects (page 37).

(6) Sea Grant Program expansion (page 44).

I hope these comments are helpful, and will be pleased to provide additional elaboration at a later date.

That is the end of the letter, and the rest of this statement is in the form of elaboration on some of these points.

The subject of oceanography is one on which NASCO has produced a number of reports summarizing from time to time the status of the field, its potential and recommendations for the future. From time to time also the Committee offers specific advice in response to questions that are posed by its agency sponsors. NASCO was asked at

various points to provide comment on the Commission's activities and members of NASCO were used from time to time as advisors to both the Council and Commission.

In particular, as chairman of NASCO I transmitted to Mr. Sam Lawrence the Committee's response to a number of questions raised by him relative to program and organization for marine sciences. Because of the way in which the questions were phrased, NASCO interpreted its replies as an addendum to its last major report on the subject, "Oceanography 1966—Achievements and Opportunities," which was developed under the chairmanship of my predecessor, Dr. M. B. Schaefer. Later, I will refer specifically to parts of this letter.

I am sure the committee is aware of the report "Oceanography 1966—Achievements and Opportunities," and we feel as a Committee on Oceanography that the recommendations in this report are still very viable.

Perhaps the most controversial and important recommendation of the Commission is that a single independent agency, designated as NOAA, be established to carry out the missions identified by the Commission as being essential to meet national needs. Our letter expresses the Committee consensus on this matter, but I would like to elaborate a little on some of the points that have been identified.

The question of Federal organization for any program, and I need not tell the committee this, has many ramifications. As all of us know, it is sometimes not so important how an activity is organized as to how the appropriate people will be involved, and the degree to which the activity is given funding and support. Organization questions should arise principally from an examination of the goals to be accomplished and the most significant thing to ask is whether our organization will meet the goals we desire. It is in this sense that NASCO believes that some new organization for oceanography is needed and has long held this position.

If I may quote from the NASCO report, "Oceanography 1966," it contained the following statement on this matter:

> In sum, under present management procedures we have 22 federal bureaus and laboratories doing separate things in and about the ocean. Through ICO they are all kept acquainted with what the others are doing and planning in the unclassified area. As much coordination is arranged for as departmental and agency policies and activities will permit—and it is considerable. These 22 executive entities report to about 29 substantive and appropriation committees and subcommittees of the Congress.
>
> Thus while Public Law 89–454, June 17, 1966, states that the policy of the United States is to develop, encourage, and maintain a coordinated, comprehensive, and long-range national program in marine science for the benefit of mankind,' we still have no national ocean program with which to implement the policy and no national ocean budget with which to fund it. National needs now require that we build the managerial structure needed to develop these instruments. Considerable coordination of managerial function in both the executive and legislative branches of the government will be necessary before these forward steps can be taken.
>
> We repeat that it is not our present intent to recommend any specific structure to accomplish the necessary improvement. We do point out that any change in the managerial structure must be consistent with the continuing needs of those existing agencies whose primary missions involve ocean activities.

That is the close of the quote which NASCO stated in its 1966 report, which we still think is germane to the question.

More recently in considering this subject for a response to questions raised by the Marine Commission staff, NASCO furnished the following statement to Mr. Lawrence:

The management of oceanography in the federal government has grown in complexity and has necessitated decisions at high levels in the federal executive structure as the program has expanded. We are now at a crucial stage when decisions must be made that will affect our nation's ability to understand and use the ocean in the decades ahead. We visualize both an improved organizational structure and a many-fold increase in the level of effort required to meet these challenges and take advantage of opportunities. By far the bulk of this effort will be in the areas of ocean engineering and resources development.

The Committee on Oceanography believes that the nation needs:

(1) a major increase in our capacity to do things in the ocean,
(2) a major increase in ocean-going and shore facilities,
(3) a major increase in brainpower,
(4) a major increase in federal funding, and
(5) a new oceanographic management structure.

The justifications for a major increase in our national ocean program have been documented elsewhere. Foremost among them are: national defense, exploitation and use of ocean resources (food, fuel, minerals, waste disposal, transportation, recreation), international cooperation and leadership, and weather and climate prediction. If we take appropriate steps now, our nation can retain its leadership in ocean activities and our future right to use the ocean and its resources. We estimate that the future cost* of this effort will be less than our present space program—$5 billion per year—but more than $1 billion per year. If present trends continue, it will take us more than ten years to grow to the $1 billion level. This is not fast enough to meet our stated national goals to understand and use the sea.

While a substantial share of the effort sketched above should be developed within the broad, general missions of the several government agencies now involved in oceanography, we do not feel that the management structure required for this magnitude of effort now exists, nor that a program of this scope can be managed effectively unless there is a commensurate change in the management structure. The change in structure should have early attention to facilitate planning and setting of priorities.

We can already see major ocean engineering and resources development programs that are many times larger in themselves than the mission assignments of any one of the several agencies. Some examples include: networks of oceanic buoys; deep-ocean habitats; data transmission, processing, collecting, and dissemination; and applied engineering and research on materials. These and many other engineering and resource development programs are of overriding national importance, of interest to several agencies, but not appropriately assigned to any single existing agency. Cooperative multiagency programs of sufficient intensity and complexity to solve these problems might be mounted provided a strong supplemental funding and coordination were available. Historical performance of federal agencies in dealing with large, multipurpose programs, however, suggests that multiagency coordination will be less effective than the creation of a new management structure.

Accordingly, NASCO recommends that: to meet the national needs in the decades ahead it is essential that there be major increase in the tools, facilities, brains and dollars available for study and exploiting the seas. If this is to be accomplished, the present government organization for supporting oceanography must be modified. This modified management structure should recognize a new mission largely related to support of ocean engineering and marine resource development. It should fill the gaps between existing programs.

That is the close of the quote from the statement which we transmitted to Dr. Lawrence in response to the questions posed by the Commission's staff.

I would like to move on and review briefly the principal arguments that have been identified by NASCO on the question of a single agency

*There are several ways to measure the total cost of a national ocean program. We are using the criteria now adopted by the National Council on Marine Resources and Engineering Development.

and specifically NOAA. These are arguments that did come up in our committee at one time or another.

One of these arguments is that existing agencies can do the job.

It can be argued that a major increase in Federal funding could produce much of what we need even without a change in management structure. Indeed, it is NASCO's opinion that often existing programs are held back by the level of funding. As our statements also point out, we do not need a modified management structure so much to coordinate and correlate the things being done now as to undertake the things that are not being done. A major increase in our capacity to do things in the ocean demands a specific management attention to doing things in the ocean.

We must expect that the agencies with major missions that are not specifically to develop ocean science and technology will rightly feel that their first responsibility is to carry out their primary mission. To act otherwise would be contrary to the will of Congress and the public trust assigned to these agencies. Therefore, we cannot and should not expect the top executive of a non-ocean-oriented agency to be the strong advocate for ocean science and technology development that the Nation needs.

Mr. KARTH. Mr. Chairman, may I interrupt?

Mr. LENNON. Yes.

Mr. KARTH. Are you specifically referring to the Department of the Interior?

Dr. CALHOUN. No, this is a general statement that we are making.

Mr. KARTH. Would you feel that this paragraph hits the Department of the Interior?

Dr. CALHOUN. I am not singling out any particular agency. It seems to me that you can't expect an agency whose mission is not necessarily to develop the oceans to take on that task.

Mr. KARTH. And Interior's is not, is it?

Dr. CALHOUN. I don't think there is any agency in the Federal Government that has the responsibility and the stated mission to develop the technology of the oceans. That is the point we are making here.

Mr. KARTH. I think you are right. That includes all of them.

Dr. CALHOUN. That includes all of the agencies.

Mr. LENNON. I think we could add the Department of Transportation. That is not their total mission.

Mr. KARTH. I would suggest to the doctor that he be not too reluctant, Mr. Chairman, to be more specific.

Dr. CALHOUN. No, sir; I simply don't believe it would be fair.

Mr. LENNON. You recall last week, gentlemen, we had the Chairman of the Committee on Oceanography of the National Academy of Engineering, and they took no position except in the broad scope. They didn't file a report. So when I received your letter late the same afternoon that the gentleman testified, I got on the phone about 6 o'clock and read it to counsel, and I said, "Now I am going to write to this gentleman and send him your letter and ask, if you folks are taking a position, why couldn't the National Academy of Engineering take a position. You are all housed in the same building and there must be dialog between you."

We will come back to that later. Go ahead.

Dr. CALHOUN. I just want to clarify one point. I didn't think it fair to single out the Department of the Interior in answer to your question. I think your comment applies to all existing agencies. None of them has a mission to develop ocean science and technology.

Mr. KARTH. Doctor, if you don't mind, I do not intend this to be derogatory in any shape or form. We invite you experts to come here and be specific on occasions, and I am inclined to think that you are not.

I wouldn't worry too much about hurting people's feelings if it happens to come about in the normal course of an event in answer to a question.

I feel this committee has a great responsibility, and we would like to have as much specificity as we can.

Dr. CALHOUN. We will be as specific as we can be.

Mr. PELLY. Would the gentleman yield?

Mr. KARTH. I yield.

Mr. PELLY. I think it would be very worthwhile to the committee for you to address yourself to the case of the Department of the Interior. We have had a very prominent witness, Captain Bauer, a former adviser to this committee, who has testified here and seems in disagreement with you on that score. I think therefore we should get down to cases.

Mr. KARTH. If the chairman will permit, that is the only reason I asked the question.

Mr. LENNON. You have not yet been furnished a copy of Captain Bauer's statement?

Dr. CALHOUN. It was handed to me about 5 minutes before the hearing started.

Mr. LENNON. I shall request that you and your associates give some thought, as much as you possibly can, to consideration of the things that he has projected in that statement, and then I would ask you to furnish for the record a statement signed by you and your three associates here this morning in which you analyze the statement and take a position. I think that is what we have to do, is to find out how you experts feel about another expert's position on something where he goes in an entirely different direction from which you are going. We have asked him to do the same thing with respect to the position that you have taken.

Dr. CALHOUN. We will be happy to look it over and advise you as to what we think we can do. I believe as I go on I may touch on some of these points.

(The information follows:)

THE TEXAS A. & M. UNIVERSITY SYSTEM,
College Station, Tex., June 27, 1969.

HON. ALTON A. LENNON,
U.S. House of Representatives,
Rayburn House Office Building,
Washington, D.C.

MY DEAR CONGRESSMAN LENNON: When I and other members of the Committee on Oceanography testified before your Committee on the Commission Report "Our Nation and the Sea," you asked us to comment in more detail on the Commission's proposed government reorganization and on the statements on this topic made by Mr. Paul Bauer. After much deliberation, I think that a response to your request goes beyond the role of the Committee on Oceanography.

I am willing personally, however, to discuss further some of the issues relative to the Commission Report and especially to elaborate on the question of a federal organization to achieve the goals set forth by the Commission. My discussion is not to be construed as a position of either the National Academy of Sciences or its Committee on Oceanography. In formulating this letter, I have availed myself of thoughts offered by others, including members of the Committee, but the views are strictly my own.

I would like to express again enthusiasm for the Commissions' report and a concern that its main recommendations be implemented in the immediate future. This report puts the importance of the oceans to the United States in proper perspective. It is apparent from the Commission's study that the oceans must be placed on the same general level of national concern as outer space, public health, foreign aid, transportation, urban problems, and many other matters of high priority. The stake of the United States in the oceans is so large and so in need of development that a new national program should be launched. Further, I believe that the strength and capability of the United States is such that it can encompass not only immediate problems such as those of the cities, but also problems of longer range potential such as those pertaining to ocean resources.

I reemphasize my former statement to the effect that organization, or reorganization, is a critical matter, but is derivative from and secondary to the recognition of a new mission for ocean affairs and to the allocation of funding to do the necessary job. If we focus our concern on programs and on goals, the need for certain organizational elements becomes clear. If nothing more is done than to combine several existing agencies into a new structure without recognizing a role over and beyond current roles, little will be accomplished. If existing agencies are brought together in a new format with no provision for additional federal expenditures, little can be done beyond what is now being done.

Some federal organization for marine affairs, stronger than the existing format, is clearly needed. Although it may not be possible to provide the ideal organization at this time, it is useful to project what the ideal might be. In this respect, I visualize a desirable ultimate federal organization as including a department of natural resources and environments which would bring into focus all federal policies and programs in these areas. Major elements of such a unified department would be sub-departments of the oceans, of the atmosphere and of other resource systems.

Clearly, this desired reorganization cannot be done without considering the role of many existing federal agencies and the manner in which they are related. However, steps to provide a focus for ocean resources cannot afford to wait upon the broader goal. Some action is needed now—action which will not prejudice, but perhaps enhance attainment of the ultimate goal.

There are many ways by which a new organization could be structured. I am of the opinion that the creation of NOAA would be better than maintaining the status quo. I recognize, as have others, that it is possible also to fashion an agency which would be either larger or smaller than the group for NOAA as recommended by the Commission.

Taking all these elements into consideration, I suggest that action at this time should be centered around three points: (1) establishing a new independent agency whose principal mission is to do things not now being done; (2) combining into the new agency a limited number of existing activities based on ocean-centered missions, and (3) providing funding to the new agency sufficient to make it a viable force toward focusing the direction of all civilian ocean development.

My reasons for believing that the new agency should be an independent agency are similar to those voiced by the Commission—

"In getting a major and diverse effort underway, the case for independent status is compelling. An independent agency can bring a freshness of outlook and freedom of action difficult to achieve within an existing department. Its greater public visibility would draw stronger public interest and support. A head of an independent agency would be better able to organize the agency's activities, to achieve the multiple purposes of a national ocean program than would an officer of a larger organization in which other interests are represented and, perhaps, dominant."

An independent agency at this time has merit simply to avoid the subjugation of the new ocean mission to any existing departmental mission until a total balanced department can be created. An independent agency is desirable at this time also so that Congress can provide a special over-view of the program apart

from existing departmental structures. With an independent agency there will be no doubt about the intent of Congress with respect to a new mission.

The administrator of the new agency should be provided with a National Advisory Committee on the Oceans much as is described on page 245 of the Commission Report and he should be designated as federal coordinator of ocean related programs much as is outlined in the Commission Report on page 231.

The mission of the new agency should be to stimulate the development of technology for and the capability of operating in and of doing things within the ocean for non-defense purposes; and to gain an understanding of the ocean environment necessary for predicting its behavior and for regulating and using the technology that is developed. It is essential that this new agency contain the core elements of a capability for approaching the complex problems of ocean development on a comprehensive scale. The new ocean agency must support science, develop an ocean technology which expands our national capability in the oceans, support conservation of resources, develop manpower through appropriate educational goals, provide knowledge that will protect the coastal zone from unwise exploitation, and in large measure, coordinate the activities of all federal agencies concerned with oceans.

The element of this new agency which was not emphasized sufficiently in the Commission's Report is that it must be capable of developing a new capacity for ocean activities in a way which no present federal agency is prepared to do.

Some component parts from existing marine activities within the federal structure might be assembled within the new agency. While I have opinions on this point, I feel that specific identification of these elements should be determined in consultation with the agencies concerned, taking into account the manner in which these existing marine activities serve non-ocean missions.

I would like to clarify the point that I recognize the need for some atmospheric sciences activities to be closely integrated with the ocean sciences. However, the federal program for the atmospheres is a broad program in its own right and goes beyond ocean-related problems. I foresee that the eventual department of natural resources and environments would provide within its structure for a department of the oceans and a department of the atmosphere. My point here is not to differ conceptually with the intent of the Commission, but rather to emphasize that a new ocean agency must have sufficient identity and strength to develop a major new thrust in marine resources and ocean development without being encumbered with non-ocean problems.

I also support the concept that the Commission program can best be implemented if there is a consolidation of Congressional committee activities supporting ocean agency activities. An appropriate way to provide this overview in Congress would be to establish within Congress a *joint committee for the oceans* or a single committee in each House at the time that the new ocean agency is established. In this way, appropriate overview of and support for the new agency would be enhanced.

Although the recommendations with respect to federal organization are important there are other recommendations of the Commission which are of equal importance to the furtherance of ocean science and which should not be overlooked. Some of these require legislative action. Others do not, but would benefit from clear Congressional support.

I suggest that the appropriate committees of Congress take whatever action is necessary on the Commission's recommendations with respect to the establishment of university-national laboratories (page 27) and with respect to coastal zone laboratories (page 29). The arguments made for these two kinds of facilities, both in the Commission Report and in the Panel reports, are compelling and well documented. Several states have already demonstrated interest in creating coastal zone authorities and coastal zone laboratories in response to the Commission's recommendations. Early action by Congress to implement these recommendations would take advantage of this initiative by the states.

In summary, I am concerned that Congress provide a national ocean development mission, new funding support to advance the use and knowledge of the oceans most effectively and a federal organizational structure for ocean affairs, in that order of importance. As an ocean scientists, I am prepared to work fully with the administrative structure which Congress determines to be best, and I think my scientific colleagues feel the same. As your Committee formulates specific legislation, I will be pleased to provide such comment and advice as I am competent to give.

Sincerely yours,

JOHN C. CALHOUN, JR.

WOODS HOLE OCEANOGRAPHIC INSTITUTION,
Woods Hole, Mass., July 16, 1969.

HON. ALTON A. LENNON,
Chairman, Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, House of Representatives, Rayburn House Office Building, Washington, D.C.

MY DEAR CONGRESSMAN LENNON: I wish to associate myself with the content of Dr. John C. Calhoun's letter to you dated June 27th. He has written you as an extension of remarks which were made when several members of the Committee on Oceanography of the National Academy of Sciences testified before the Subcommittee. Since he is writing you as an individual, I wish to add my support to this position.

All members of the Committee on Oceanography feel strongly that the Commission report must be implemented through early action in Congress. If there is any way we can assist you in your fine endeavors, please let us know.

Sincerely yours,

PAUL M. FYE.

Dr. CALHOUN. A second argument that came up in our discussions is that important ocean tasks could be assigned to separate "lead" agencies.

This suggestion is a variation on the first theme. It has some merit but again it has weaknesses, and we think they are twofold.

If different major tasks of ocean technology development are assigned to different agencies—for example, development of an operational buoy network to one agency and a national data collection processing and dissemination facility to another agency—there is loss of the advantages of efficiency and flexibility that should result if both are managed by one agency.

If several major tasks are assigned to a single lead agency there could develop in that agency a major ocean-oriented thrust that, if properly managed, could grow to a proportion where the original non-ocean-oriented missions of the agency would take second place.

In either case there is a loss.

Oceanography in the United States has come of age and there is every reason to expect that in the next decade the ocean-oriented activities of our Nation will expand manifold. The forces that are driving us in this direction will produce this high level of activity whether a new agency is created or not. Thus, within the next decade we will need a managerial structure in our Government to match this activity. If this structure grows in one of the existing agencies, it can only thrive at the cost of other vital and legitimate missions.

Third, the argument is presented that the establishment of NOAA should be deferred pending studies of the need for an agency of the environment.

In my opinion there is merit to the proposal that an agency of the environment be established. While this is not the place to examine in detail the problems of reorganization of our Government, we should recognize that such matters are under continual study and review.

Furthermore, we should remember that our Government structure is flexible and does change. One such major and courageous change was taken immediately after World War II when three departments of military forces were combined into one Department of Defense. Similar steps could be taken now to strengthen and make our Government more efficient in the area of natural resources and environments.

However, I do not foresee such steps being taken in the next few years. In this context, the proposed agency for the oceans and atmos-

phere should be considered as part of the natural governmental evolution in reorganization. We can proceed with a step now that can be taken without prejudicing, perhaps actually enhancing, a future, more broad-scale reorganization.

A fourth argument is that removal of major complements from existing agencies would degrade the agencies' capability to carry on non-ocean-oriented functions.

NASCO hesitates to recommend specific existing agencies that ought to be clustered into a new Federal organization. Decisions on this point encompass more than scientific capability. However, we should be more concerned with what needs to be done than with whether an existing agency should be maintained intact.

The importance of mission-oriented ocean research has long been recognized by NASCO and the degree to which a specific ocean mission is divorced from other missions is indeed a complex question. Capability of an existing agency to perform essentially a nonocean mission should not be limited by denying it a role in ocean research, in our opinion. NASCO's view is that the particular agencies that may be brought together for forming a new organization is not nearly so important as recognizing that there is a new job to be done over and apart from that which any existing agency is doing.

A fifth argument that has come up is that the proposed combination of agencies for NOAA is wrong.

I do not wish to suggest that the Committee on Oceanography supports the view that the specific combination of agencies suggested by the Commission for NOAA is necessarily the optimum combination. As individuals, we have different views on whether certain organizations should or should not be included as well as whether some organizations not identified by the Commission should be added to the proposed NOAA. Many factors must be considered. Many groups and organizations and the agencies must be heard from.

However, we do believe that the establishment of a single ocean agency is in the best interest of the Nation and of the science of oceanography. While we are more expert on the latter point than the former one, we do not believe that we are politically naive on the former point.

From a science point of view, most of us are very receptive to the idea that the ocean and atmosphere be examined as part of one physical system. On the other hand, the program of atmospheric control for weather pollution in an inland city, or the suppression of hail in the Rocky Mountain area may bear little relationship to the ocean problem. If one asks the question, can the meteorological activity and oceanographic activity be mutually advanced by common administration, one is likely to arrive at a positive answer, provided that in the process neither one of these very important areas of science is subjugated to the other.

On the coastal zone question, it is necessary to ask whether the coastal zone problems are really oceanographic in nature. Some of the important agencies that deal with coastal zone problems do not appear to have been considered in the Commission's recommendations, for example, the Corps of Engineers of the Department of Defense which plays a very large role in coastal zone activities.

The specific mission for a new organization as seen by the Commission therefore appears to have a dichotomy—to be oriented on the one

hand toward a single geophysical system representing the ocean and the atmospheres together, but on the other hand to be oriented also to the problems of people living along the coast. A new Federal organization might be focused on one or the other of these. Can it be focused on both?

These are offered as some of the questions about organization which, indeed, came up in our discussions and which Congress will need to consider. The statement contained in "Oceanography 1966" is still germane: "We repeat that it is not our present intent to recommend any specific structure to accomplish the necessary improvement. We do point out that any change in the managerial structure must be consistent with the continuing needs of those existing agencies whose primary missions involve ocean activities."

At this time, therefore, individual members of the Committee on Oceanography could give you individual opinions as to which agencies they think might be involved in reorganization structure. As a group, we have no consensus opinion.

My own individual posture on this has been stated in a letter which I addressed to President Nixon in which I have expressed the view that whatever is done ought to be within the context of a broader reorganization of the Federal Government with attention given to our needs for a Department of Natural Resources and Environments.

In the letter which I read at the outset, NASCO has identified six specific program items of high priority. Members of the committee who are with me this morning will speak to some of these points and to others of major interest to them, and they are also free to talk on the reorganization question and give their individual opinions.

Some members of NASCO have appeared already before this committee as spokesmen for other groups. I would point out that one member, Dr. Knauss, is a member of the Commission. Dr. Paul Fye gave a statement on the need for a fundamental technology program which I am sure the other members of NASCO would endorse.

Before I turn to these other persons, however, I wish to urge this committee to move ahead with all speed to implement the thrust of the Commission report. Although we may differ on details, none of us differ with its message. The Commission has performed a mighty service for the Nation in this respect.

As with all affairs of men, there comes a time to act. We think our Nation has reached this point with respect to marine resources. We have seen the development of ocean science through an age of classical oceanography followed by a more recent era of broader marine investigations. Parallel to that, of course, we have had always an empirical use of the ocean which began with man's earliest ventures into the sea for transportation and fishing and which continues to date in a not greatly modified sense.

These two broad avenues of involvement, the scientific and the pragmatic, are now slowly coming together. If the marriage can be stimulated, there is much promise for mankind. Already, in the courtship phase, it is possible to see how scientific activity has made some contributions to the empirical uses of the sea. Conversely, it is apparent that the role of engineering has stimulated greater scientific activity. What is now needed is a catalyst for speeding up the reaction.

The public is not unaware, in our opinion, of the promises of the

sea. In fact, it is a tribute to the lasting creativity of our people and an expression of our pioneering characteristics that we look with longing upon this new environment to conquer. The expectancy of promise is demonstrated by the public in many ways—through the formation of local groups such as the American Society for Oceanography, and these are interested public citizens; through the interest in ocean investments; through the wide concern for pollution; through the growing recreational use of the shore; through the support of such educational programs as the sea grant program.

And I might point out that in the last 3 days in Houston, Tex.. at the offshore technology symposium, industry demonstrated their awareness of this field. There were some 400 people registered and a tremendous display of this Nation's capabilities and budding interest in the whole field of ocean technology.

The public is in fact waiting for a signal. They are waiting for Congress to announce goals and provide the stimulus for action. Just as our Nation looked to the West and waited upon national leadership to open up the public lands for development, so today the public is waiting for Congress to supply the leadership that will bring forth the promise held by marine resources.

There is another sense in which our Nation must lead the oceanographic dialog. This is on the international scene. Our Nation has a responsibility to know; a responsibility to understand the ocean and its potential, so that we can lead in the right direction and not be led in the wrong direction. Only the strong can ever fulfill the responsibilities of the need to know, and this Nation must carry this responsibility for much of the need to know on the international scene so far as the oceans are concerned.

Recently there was a book edited by Edmond A. Bullion called "Uses of the Sea," prepared for the American assembly, and I might say that the American assembly is another evidence of the interest of the public in this field. These American assemblies have been held all over the Nation.

Let me quote what appears in the foreword:

> The future course of ocean science and technology is now relatively easy to foretell, but the economic, political and social implications of these projected developments are infinitely complex. We have yet to learn the ultimate economic potential of the sea bottom. We have yet to explore the ocean as a source of food for hungry people. We have yet to learn how to halt the pollution of our coastal waters. As we move down the continental slope and out along the deepest ocean floor, a multitude of questions arise that cannot wait too long for an answer * * *. Above all, how do we mobilize the resources of industry, of finance, and of Government to take advantage rapidly and effectively of the vast promise of our new technology?

He asks a very cogent question. That is why we feel the deliberations of this commitee are so important.

It is time to move and we stand ready to help further in deliberating the wisest course.

I think perhaps one other thing I might say as chairman of the committee is to call to your attention that we have been engaged in a joint activity with the National Academy of Engineering, Committee on Ocean Engineering in preparing for the Marine Council an exploratory program for the international decade of ocean exploration.

There has just been published this book called, "An Oceanic Quest," which I hope has been brought to your attention, Mr. Chairman. It also expresses some of the future that we see in this area.

I think that perhaps the best thing would be to turn to these gentlemen. Dr. Charles Drake, from Lamont Laboratory at Columbia University, who is a member of the committee. I will turn the microphone over to him.

Mr. LENNON. Thank you, gentlemen. We will withhold questioning until each member of the panel has been heard.

We have here, too, a career résumé of Dr. Drake, and I ask unanimous consent that this be inserted in the record immediately preceding his remarks. I do want people who read this record to know the background of these witnesses.

Now you may proceed, Doctor.

Let that be true, also, of each of the other gentlemen, Dr. Paulik and Dr. Pritchard, that their biographical sketch and career résumé appear in the record immediately preceding their statement.

(Dr. Drake's biographical sketch and career résumé follows:)

CHARLES L. DRAKE—CURRICULUM VITAE

(Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York)

Address: 2 South Boulevard, South Nyack, N.Y. 10960 Area 914 358–0515.
Born: July 13, 1924, Ridgewood, New Jersey.
Married: Martha Ann Churchill, four children.
Education: Chatham High School, Chatham, N.J., 1941; Princeton University, 1941–43; 1946–48, B.S.E. (Geological Engineering); Columbia University, 1958, Ph. D. (Geology).

PROFESSIONAL POSITIONS HELD

Research Associate, Lamont Geological Observatory (Columbia University) 1948–56.
Lecturer in Geology, Columbia University, 1953–55.
Senior Scientist, Lamont Geological Observatory (Columbia University) 1956–58.
Instructor in Geology, Columbia University, 1958–59.
Assistant Professor of Geology, Columbia University, 1959–62.
Associate Professor of Geology, Columbia University, 1962–67.
Acting Assistant Director, Lamont Geological Observatory (Columbia University) 1963–65.
Educational Coordinator, Department of Geology, Columbia University, 1965–67.
Professor of Geology, Columbia University, 1967–.
Chairman, Department of Geology, Columbia University, 1967–.

MEMBERSHIP ON PANELS AND ADVISORY COMMITTEES

Working Group on Geology and Geophysics, International Indian Ocean Expedition, 1960–61.
Working Group on Solid Earth Problems, Geophysics Research Board, National Academy of Sciences, 1960–64.
Ocean Surveys Panel, Committee on Oceanography, National Academy of Sciences, 1961–65.
Ad Hoc Committee on Oceanography, President's Science Advisory Committee, 1963–64.
Advisory Committee on Oceanography, U.S. Coast and Geodetic Survey, 1961–66.

Upper Mantle Committee, Geophysics Research Board, National Academy of Sciences, 1963–.
Visiting Team Member, Geological Education Orientation Study, American Geological Institute, 1961–62.
Planning Committee, JOIDES (Joint Oceanographic Institutions Deep Earth Sampling) Project, 1964–; Chairman, 1966–68; Executive Secretary, JOIDES, 1967–68.
Earth Sciences Section Advisory Panel, Division of Mathematical and Physical Sciences, National Science Foundation, 1964–66.
Subcommission on African Rifts, International Upper Mantle Committee, IUGG–IUGS, 1965–.
Commission on Continental Margins and Island Arcs, International Upper Mantle Committee, IUGG–IUGS, 1966–.
Committee for the Promotion of the UMP, IUGS, 1968–.
Advisory Panel, Oceanography Section, Division of Mathematical and Physical Sciences, National Science Foundation, 1967–68.
Committee of Direction, Compilation of Crustal Seismic Profiles, IUGG, 1966–.
Committee on Oceanography, National Academy of Sciences, 1967–.
Committee Advisory to ESSA, National Academy of Sciences/National Academy of Engineering: Main Committee, 1968–; Marine Activities Panel, 1967–; Chairman, Panel Advisory to ERL, 1968–.
Committee on Post-UMP Activities, Geophysics Research Board/Committee on Oceanography/National Committee on Geology, 1968–.
Ad Hoc Committee on Solid Earth Problems, IUGG/IUGS, Chairman, 1968–.

OTHER

Distinguished Lecturer, AAPG, 1961.
Special editor, GEOPHYSICS, issue on engineering geophysics, 1961.
Co-editor, AGU Monograph No. 12, 1967–68.
Board of editors, Journal of Marine Research, 1966–.
Senior Post-Doctoral Fellow, NSF, 1965–66.
Condon Lecturer, Oregon University System, March 1969.
Trustee, Village of South Nyack, 1963–65, 1966–69; Deputy Mayor, 1968–69.
Director, Rockland Foundation, 1961–64.
Director, National Youth Science Foundation, 1966–68.
Member, Cosmos Club, Washington, D.C., 1964–.

ACTIVITIES

1943–46: U.S. Army Corps of Engineers (New Guinea & Philippines).
1947: Gravity and magnetic measurements in eastern United States and Canada with G. P. Woolard, then of Princeton University.
1948–49: Gravity measurements at sea aboard submarines in Atlantic, Pacific, and Arctic.
1950: Seismic refraction measurements in Hudson River for Thruway Bridge foundations and in Long Island Sound.
1951: Seismic refraction measurements in the Gulf of Maine. Chief Scientist RV *Caryn* on cruise in North Atlantic.
1952: Participated in cruise abroad MV *Kevin Moran* in company with RV *Atlantis* in Atlantic Ocean.
1954: Participated in cruise of RV *Vema* in central Atlantic.
1955: Chief Scientist RV *Vema* on cruise between Bermuda and New York. Participated in program of missile impact location on Grand Bahama Island.
1956: Chief Scientist MV *Theta* for joint cruise with RV *Vema* to Gibraltar, and with Spanish vessel Patrollero V–17 in Spanish waters.
1957: Chief Scientist RV *Vema* during joint cruise with Argentine vessel *Bahia Blanca* between Cuba and New York.
1958: Chief Scientist RV *Vema* during joint cruise with RV *Atlantis* in Red Sea and Mediterranean Sea.
1959: Participated in survey of area north of Puerto Rico for possible drilling site to Earth's mantle. Joint cruise with MV *State Star* carrying out seismic refraction measurements in Bahama region.
1960: Chief Scientist RV *Vema* during cruise from New Zealand to Cape Horn. Chief Scientist RV *Vema* during joint cruise with Canadian vessel *Sackville* to northern waters.
1961: Chief Scientist RV *Vema* during joint cruise with Canadian vessel *Sackville* in Labrador Sea and Gulf of St. Lawrence.

1962: Chief Scientist RV *Vema* from Panama through Gulf of Mexico, and Caribbean to North Atlantic and New York.
1963: Participated in search for submarine *Thresher*, June–July, aboard RV *Conrad*. Chief Scientists RV *Vema* from Abidjan to New York.
1964: Participated in joint French-U.S. Operation Deepscan dives in bathyscaphe *Archimede* in Puerto Rico trench area. Chief Scientist RV *Vema*, Recife-Bermuda-N.Y.
1965: Co-secretary, UNESCO/UMC Conference, Nairobi, Kenya. Participant, International UMC Symposia, Ottawa, Canada.
1965–66: National Science Foundation Senior Post-Doctoral Fellowship; Sabbatical leave spent at Cambridge University, England. Participated in operations of bathyscaphe *Archimede* off Greece.
1967: Microearthquake studies in Kenya and Iceland.
1968: Microearthquake studies in Iceland.

STATEMENT OF DR. CHARLES L. DRAKE, LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, COLUMBIA UNIVERSITY

Dr. DRAKE. Thank you, Mr. Chairman.

I have been asked to speak to the subject of national projects as recommended by the Commission.

These projects were proposed to stimulate and support fundamental technology and to provide national facilities with the ultimate aim of lowering the cost of marine technological applications by industry, the scientific community and Government.

Some of the suggested projects are designed to attack critical problems of immediate concern to large segments of our population, others to provide a technological base for future development. NASCO has endorsed the concept of national projects in principle although individual members might differ in their opinions about priorities and might also offer other projects as suitable for consideration as national projects.

Exploration and development of the oceans is and has been technology limited. I can speak with the greatest assurance within the framework of my own field which is marine geology and geophysics. Many, or perhaps even most, of the major developments in this field nave resulted from work by oceanographers in this country and each major discovery can be traced back to the development of a new technique for studying the ocean floor.

At the end of the Second World War, precision echo sounders did not even exist. As soon as accurate timers were attached to existing echo sounders, major features of the sea bottom, such as the great flat abyssal plains and midocean canyons, were revealed and it became possible to study the minor features.

The echo-sounding data combined with underwater photographs and sediment samples obtained with coring devices revealed the nature of the sediments and the sedimentary process, including bottom currents and mass downhill movements at high velocities.

Magnetometers, adapted from devices developed for detecting submarines, have revealed a systematic magnetic striping of the ocean floor which appears to be related to the age of the crystalline rock beneath the sediments on the ocean floor.

The data suggest major horizontal movements of the ocean floor and have revolutionized geological thinking about the origin of ocean ridges and mountain systems.

Continuous reflection techniques have revealed the presence of such features as dome-like structures on the deep floor of the Gulf of Mexico

which have recently been revealed to be oil-bearing. The vessel which drilled a hole on one of these structures used technology developed by the petroleum industry coupled with technology developed under Project Mohole.

These are but a few examples to illustrate the major developments which follow the introduction of new technology. One might even, in a sense, say that the technology was generated by a national project since a majority of the devices were offshoots of programs undertaken during World War II—a major national project.

It is unfortunate, but nevertheless true, that many major technological advances occur during wars. Surely, through proper planning, they can be encouraged without the necessity of such drastic measures.

The Commission has considered this question carefully and has designed three types of projects: (1) the creation of facilities for testing and calibrating new instruments and equipment; (2) feasibility studies of major problems of human ecology; and (3) extension of existing technology to provide a base of fundamental knowledge upon which future developments can be based.

These are worthy objectives and worthy of support. They will require industry participation to a far greater extent than has been the case during the past 20 years. They should open many new avenues for the ultimate utilization of the oceans.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Dr. Drake.

Mr. CALHOUN. Dr. Paulik from the University of Washington.

(The document referred to follows:)

BIOGRAPHY OF GERALD J. PAULIK

I. *Address.*—Home: 6218—20 N.E. Seattle, Washington 98115 206—LA 3-0679
Business: Center for Quantitative Science in Forestry, Fisheries and Wildlife, Fisheries Hall No. 2 University of Washington, Seattle, Washington 98105, 206—543-1191 and 543-4668

II. *Current Research Interests and Areas of Expertise:*
Population dynamics, resource management, computer simulation of biological systems, population ecology, statistics and experimental design, electronic data processing, fluid dynamics, and educational simulation games.

III. *Summary of Professional Experience:*

Sept., 1968 to Present.—Professor, College of Fisheries, University of Washington, Seattle, Washington.

April, 1968 to Sept., 1968.—Visiting Professor, Biometrics Unit, Cornell University, Ithaca, New York.

Sept., 1967 to April, 1968.—Consultant, Inter-American Tropical Tuna Commission, La Jolla, California.

Sept., 1964 to Sept., 1967.—Associate Professor, College of Fisheries, University of Washington, Seattle, Washington (Promoted to Full Professor, Sept., 1967).

Sept., 1962 to Sept., 1964.—Assistant Professor, College of Fisheries and Fisheries Research Institute, University of Washington, Seattle, Wn.

June, 1962 to Sept., 1962.—Research Assistant Professor, Department of Mathematics, University of Washington, Seattle, Washington.

June, 1961 to June, 1962.—Biometrician, Fisheries Research Institute, University of Washington, Seattle, Washington.

Sept., 1960 to June, 1961.—Research Instructor, Department of Mathematics, University of Washington, Seattle, Washington.

Sept., 1959 to Aug., 1960.—Postdoctoral Fellow, Department of Statistics, University of Chicago, Chicago, Illinois.

Previous to 1959.—Research Associate at the University of Washington, Biologist at the Washington State Department of Fisheries.

Duties as University Professor include:

Teaching graduate sequence of courses in *Quantitative Population Dynamics*; occasionally teaching courses in statistics and biomathematics.

Supervise Ph. D. and Master's candidates in the College of Fisheries and in Biomathematics at the University of Washington.

Supervise training grants and contract research:

Principal Investigator.—a. Simulation Games for Resource Managers (Ford Foundation).

Co-Investigator.—b. Quantitative Ecology and Resources Management Training Grant (Ford Foundation).

c. Aquatic Stock Management (Sea Grant, NSF).

d. Estuarine Ecology (U.S. Public Health Service).

Previous contract research as principal or co-investigator includes water simulation studies, pink salmon tagging analysis, mathematical models of exploited animal populations, studies of the effects of gear limitation in northern Puget Sound, and energistics of fish locomotion.

Intra-University Committees (University of Washington):

Budget and Planning (College of Fisheries), Fisheries Analysis Center (Chairman, College of Fisheries), Cost Centers, Applied Mathematics, Computer Science, Biomathematics, Quantitative Ecology and Resource Management Program, and Biology Teaching.

Consulting Clients During Past 7 years (most consulting done during summers between academic years).

(1) Alaska Department of Fish and Game, Juneau, Alaska.
(2) M. Bell, Consulting Engineer, Seattle, Washington.
(3) Chelan County Public Utility District No. 1, Wenatchee, Washington.
(4) Fisheries Research Board of Canada, Pacific Biological Laboratory.
(5) Ford Foundation, New York, New York.
(6) Grant County Public Utility District No. 2, Ephrata, Washington.
(7) Smithsonian Institute, Washington, D.C.
(8) U.S. Bureau of Commercial Fisheries, Auke Bay Laboratory, Alaska.
(9) U.S. Bureau of Commercial Fisheries, Montlake Laboratory, Seattle, Wn.
(10 U.S. Public Health Service, Water Supply and Pollution Control, Pacific Northwest, Portland, Oreg.
(11) Washington State Department of Fisheries, Olympia, Washington.
(12) Western Fish Disease Laboratory, Sand Point Naval Air Station, Seattle.
(13) Oregon Fish Commission, Clackamas, Oregon.
(14) California Dept. of Fish and Game, Sacramento, California.

Major Consulting Duties:

Design and analysis of oyster larvae bioassays; statistical consultant for program to determine effects of pulp mill pollution in Puget Sound; fish passage efficiency studies; mortalities of downstream migrant salmonids in Francis and Kaplan turbines; and design and analysis of physiological experiments.

IV. *Education:*

St. Martins College—Lacey, Washington (9/48–6/49) Science pre-major.

University of Puget Sound—Tacoma, Washington (9/49–6/50) Science pre-major.

University of Washington—Seattle, Washington (9/50–6/59). B.S. 1953 (zoology, fisheries), Ph. D. 1959 (biology, mathematics, fisheries).

University of Chicago—Chicago, Illinois (9/59–6/60), Postdoctoral fellow in statistics.

V. *Professional Societies:*

American Fisheries Society.
American Institute of Fishery Research Biologists.
American Statistical Association.
Ecological Society.
Biometric Society.
Operations Research Society of America.
Pacific Fisheries Biologists.
Sigma Xi.

VI. *Professional Activities:*

Member of: National Academy of Sciences Committee on Oceanography (NASCO); National Oceanographic Data Center Advisory Board; NASCO Marine Data Panel; Committee on Public Affairs of the Ecological Society of America; Biometric Society-AIBS Program Committee; Membership Committee, Western Division, American Fisheries Society; Fisheries Terminology Glossary Committee, American Fisheries Society.

Chairman of Biometric Society-AIBS Program Committee for 20th Annual AIBS Meeting (1969).

Past committee work includes membership on NASCO Panel on Quantitative Models in Biological Oceanography and Chairman of Inter-Agency Rock Island Dam Study Group.

Professional Journal Editorial Services.—Referee for: Biometrics, Chesapeake Science, Ecology, Journal of the American Statistical Association, Journal of the Fisheries Research Board of Canada, Journal of Wildlife Management, Limnology and Oceanography, Transactions of the American Fisheries Society.

Associate editor of *Transactions of the American Fisheries Society* (1966–69).

VII. *Miscellaneous:*

Honors: Seattle Times scholarship award in fisheries (1954). Postdoctoral award in statistics from University of Chicago ($5,500 fellowship, 1959–60).

VIII. *Summary of Publications:*

Thirty-one publications in professional journals between 1956 and 1969. Five representative titles of recent publications are:

1966 Management analysis for a salmon resource system. Chapter 9 in Systems Analysis in Ecology, K. E. F. Watt (ed.), Academic Press, New York: 215–250. (with J. W. Greenough, Jr.)

1967 Digital simulation of natural animal communities. In *Pollution and Marine Ecology*, T. A. Olson and F. J. Burgess (eds.). Interscience Div., John Wiley, New York: 67–88.

1967 Exploitation of multiple stocks by a common fishery. *J. Fish. Res. Bd. Canada 24*(12) :2527–2537. (with A. S. Hourston and P. A. Larkin.)

1969 Statistical calculations for change-in-ratio estimators of population parameters. *J. Wildl. Mgmt. 33*(1) :1–27. (with D. S. Robson); Digital simulation modeling in resource management and the training of applied ecologists. Chapter 14 in *Ecological Systems Research*, B. C. Patton (ed.). Academic Press. N.Y. (in press).

(See Bibliography for complete list of publications.)

STATEMENT OF DR. GERALD J. PAULIK, COLLEGE OF FISHERIES, UNIVERSITY OF WASHINGTON, SEATTLE, WASH.

Mr. Paulik. Mr. Chairman, my name is Gerald Paulik, and I am a professor of fisheries at the University of Washington in Seattle. I would like to thank you and your distinguished committee for providing me the opportunity to appear before you to present my views on the report "Our Nation and the Sea" prepared by the Commission on Marine Science, Engineering and Resources.

I have been asked by our NASCO chairman, Dr. John Calhoun, to comment on the marine biological resources aspects of the Commission report.

As a professor whose primary teaching and research interests have been concerned with the population dynamics of exploited fish stocks, I found the Commission's report to be a timely and masterful exposition of the problems we face as a Nation attempting to make wise use of the living resources of the oceans. The report comes at a time of great national concern about the many problems confronting our domestic fishing industry.

Total world production of fish and shellfish has expanded steadily since World War II. The average rate of growth of world production is above 6 percent per year. However, the size of the United States catch during this postwar period has remained remarkably constant, and thus our relative position has declined.

There has not been a corresponding decline in demand for fishery products in the United States. Quite the contrary—statistics just

released by the Bureau of Commercial Fisheries show that fishery products from a catch of over 17 billion pounds were consumed in the United States in 1968. This compares to a consumption of just over 7½ billion pounds one decade ago in 1958.

Imports made up 37 percent of the total consumption in 1958. In 1968, 76 percent was imported. The United States is now sixth behind Peru, Japan, mainland China, Russia, and Norway in total landings of fishery products.

However, it should be mentioned that the value of our fishery landings is second only to that of Japan's. These statistics have not been entirely responsible for the recent expressions of concern about our fishing industry. The appearance of large foreign fishing fleets near our coasts has dramatized the issue.

The Commission report explains the causes behind our relative decline as a fishing Nation and proposes that we adopt as a national goal the rehabilitation of the harvesting sector of our domestic commercial fisheries. The Commission recommends that special emphasis be placed on increasing production by United States flag vessels from latent fishery resources adjacent to our own coasts. These recommendations are, in my opinion, sound and deserving of support.

The Commission sets forth a comprehensive program for strengthening our domestic fisheries. The most important parts of this program are:

(1) Legal and political reforms to rationalize the present confused and archaic jurisdictional system of local, State, and Federal laws for managing fisheries.

(2) More emphasis by our management agencies upon the economic performance and perhaps somewhat less emphasis upon the biological performance of specific fisheries.

(3) Initiation of studies leading to mechanism for regulating entry of gear into certain fisheries.

(4) An enlarged engineering development program to advance our technological capability to harvest and market fishery resources.

(5) Scientific research and exploration to locate and determine the quantity and quality of the fish resources adjacent to our coasts as well as to improve our understanding of the productivity of these resources.

These recommendations for a domestic program are well designed to foster a more favorable climate for private development of the harvesting sector of the U.S. fishing industry.

A new, strong, and independent government agency dedicated to ocean affairs would provide an effective administrative structure for implementing the domestic fisheries program recommended by the Commission. Although we are making substantial progress on some parts of this program under our present administrative structure—and I do not mean to belittle in any way the activities of the dedicated and capable administrators, technicians, and scientists working on fisheries problems—I do believe our fisheries program would benefit greatly from being part of an environment which provides the type of long-range engineering research and development support needed to make significant technological advances in our modern industrial society. Adequate advanced engineering support and program coordination is difficult under present arrangements.

As a population ecologist, I am especially pleased by the Commission's recommendations for extensive exploration for latent resources and monitoring of environmental changes in the oceans surrounding our continent. Individual fish stocks exist as parts of multispecies systems, and it is of great importance to measure the characteristics of other components of the biological community as well as those of the single stock being fished.

Far too often in the past we have waited until some stock has been seriously damaged before initiating adequate scientific studies. Biological studies of intensely exploited stocks are very expensive and are not nearly as informative as studies started before exploitation begins and continued while the fishery develops.

I must confess less personal enthusiasm for the Commission's recommendations concerning international fisheries affairs. On the positive side, I support their recommendations that:

(1) The United States work to improve and extend the existing framework of specific bilateral and multilateral agreements.

(2) Operational ecological units should be defined to serve as a basis for international fisheries regulation in place of existing management schemes based on either one species or a small number of species.

(3) International fisheries commissions should have their own scientific staffs, and the enforcement and arbitration machinery of international conventions should be strengthened.

On the negative side, I do not believe we know enough to support wholeheartedly overall area total catch quotas, such as that proposed for the cod and haddock stocks of the North Atlantic. Misapplication of a similar quota scheme was partly responsible for the near destruction of the Antarctic whale stocks.

The problem of how to properly manage international fisheries is enormously complicated and needs a great deal more study.

I was also disappointed that the Commission did not emphasize more strongly the need for more research on new techniques for collecting and organizing data to make them truly useful for managing large international fisheries.

However, any such disagreements on specific proposals are of minor importance. The overriding issue is the necessity to create a new, strong, and independent governmental entity oriented toward the use of the sea and its resources. I strongly support the Commission's recommendations for such an agency.

Mr. LENNON. Thank you, Doctor.

Mr. CALHOUN. Dr. Donald Pritchard of Johns Hopkins University.

(The document referred to follows:)

BIOGRAPHICAL DATA OF DONALD WILLIAM PRITCHARD, SEPTEMBER 1968

Born: Santa Ana, California, October 20, 1922.

Education: B.A. Degree in Meteorology, University of California at Los Angeles, 1943. M.A. (1948) and Ph. D. (1951) degrees in Oceanography, Scripps Institution of Oceanography, University of California, La Jolla, California.

Present Employment: Director, Chesapeake Bay Institute, The Johns Hopkins University (since 1951); also Professor of Oceanography, Department of Earth and Planetary Sciences, The Johns Hopkins University.

Past Professional Employment: Served as Weather Officer in World War II, forecasting sea and swell for amphibious landing operations in Normandy and in Pacific. Head, Current Analysis Section, Scripps Institution of Oceanography, 1946. Oceanographer, U.S. Navy Electronics Laboratory, San Diego, California,

1947–48. Associate Director, Chesapeake Bay Institute, The Johns Hopkins University, 1949–1951. Chairman, Department of Oceanograph, The Johns Hopkins University, 1950–1968.

Professional Activities

National Boards and Committees: Member, Committee on Oceanography, National Academy of Sciences (NASCO). Chairman, Panel on Oceanographic Data (NASCO). Member, Panel on Radioactivity in the Marine Environment (NASCO). Member, Advisory Committee on Isotopes and Radiation Development, U.S. Atomic Energy Commission. Member, Marine Resources Advisory Committee, Department of the Interior.

State Boards and Committees: Member, and current Vice-Chairman, Board of Natural Resources, State of Maryland. Member, Air Quality Control Advisory Council, State of Maryland. Member, Radiation Control Advisory Board, State of Maryland. Member, Commission on Submerged Lands, State of Maryland. Member, Study Commission to Investigate Problems of Water Pollution in Maryland. Consultant to Special Commission on Pollution, State of Maryland.

Professional Societies, Editorial Boards, and Honors: Fellow, American Geophysical Union; Past President, Past Vice President and Past Secretary, Section of Oceanography, Life Fellow, The International Oceanographic Foundation; Member, American Society of Limnology and Oceanography; Past Vice-President, Member, Society of Sigma Xi; Past President and Past Vice-President, JHU Chapter; Member, American Association for the Advancement of Science; Member, Atlantic Estuarine Research Society; Board of Editors, The Johns Hopkins Oceanographic Studies; Board of Editors, Journal of Marine Research.

Past Professional Activities: National Academy of Sciences Representative on the Advisory Board to the National Oceanographic Data Center, 1960–1968; Consultant to Special Advisory Committee on Department of Commerce, The National Academy of Sciences, 1959; Consultant, Sub-Committee on Oceanography and Fisheries, Committee on the Biological Effects of Atomic Radiation, National Academy of Sciences; Chairman, Panel on Waste Disposal from Nuclear Powered Ships, Committee on the Biological Effects of Atomic Radiation, National Academy of Sciences; Panel member, Radioactive Waste Disposal into the Sea, International Atomic Energy Agency, Vienna, Austria; Member, Ad Hoc Expert Committee on Radioactive Materials in Food and Agriculture, Food and Agricultural Organization of the United Nations, Rome, Italy.

Publications: Author of some 50 scientific papers published in scientific journals, in symposia proceedings, in encyclopedia, and as chapters in text books, on such subjects as the physical oceanography of the Arctic and Antarctic; the physical limnology of lakes; the kinematics and dynamics of estuarine circulation and on the distribution of constitutents in estuaries; the processes of diffusion in estuaries, coastal waters and in the ocean; the fate of radioactive materials in the marine environment; and the eutrophication of estuaries.

STATEMENT OF DR. DONALD W. PRITCHARD, DIRECTOR, CHESAPEAKE BAY INSTITUTE, THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD., AND MEMBER, COMMITTEE ON OCEANOGRAPHY, NATIONAL ACADEMY OF SCIENCES

Dr. PRITCHARD. Thank you.

I am Dr. Donald W. Pritchard, director of the Chesapeake Bay Institute, The Johns Hopkins University, and professor of oceanography in the Department of Earth and Planetary Science at the University, having been formerly chairman of the Department of Oceanography, which has now been combined into the new Department of Earth and Planetary Sciences.

I am a member of the Committee on Oceanography of the National Academy of Sciences.

I wish to thank you for providing me with this opportunity to present my opinion on the report of the Commission on Marine Science, Engineering and Resources and on the implications of the findings of

that commission on the future of our Nation in the marine environment.

The final report of the Commission, "Our Nation and the Sea," together with the several panel reports, constitute a monumental undertaking of exceptional caliber and value. Recognition should be given to the unselfish expenditure of time and effort by the members of the Commission in this service to their country.

First, I wish to endorse the prepared statement presented to you by Dr. John Calhoun on behalf of the Committee on Oceanography of the National Academy of Sciences. My purpose here is to amplify certain areas of that statement and to comment on those areas of the Commission report which fall in areas within which I have a particular competence and experience.

For the past 20 years I have concentrated my professional activities in studies of the estuarine and coastal marine environment. During that time I have also contributed to the efforts of my present home State to properly manage the multiple uses of the estuarine and coastal environment falling under State jurisdiction. I currently serve on some half-dozen State boards, commissions, and special study committees concerned with natural resources.

I have also on occasion been called upon to give advice to other States in regard to management of the coastal marine environment.

My activities have therefore been closely related to much of the subject matter contained in chapter 3, "Management of the Coastal Zone," of the Commission report.

I strongly endorse the specific concept of joint Federal-State responsibility for the coastal zone as stated in the Commission report. The actual management functions should, as recommended by the Commission, remain a State responsibility. The Federal role should be to effectively use the various means recommended by the Commission to encourage the coastal States to strengthen their administrative structure for management of the coastal zone and to aid these States in attaining the knowledge of this environment necessary for wise management.

Specifically, I endorse the Commission's recommendation for enactment of a Coastal Management Act to provide policy objectives for the coastal zone and authorize Federal grants-in-aid to facilitate the establishment of State coastal zone authorities empowered to manage the coastal waters and adjacent lands.

Man's impact on water quality and other properties of the coastal zone influencing the value and character of man's use of this environment is controlled to a large degree by decisions regarding use of the lands adjacent to the estuaries and other coastal waters, even the use of the lands in major watersheds supplying the surface runoff to estuaries and other coastal waters. A number of States are in the process of consolidating their management of the natural resources. But even in those States which have taken the most advanced steps in this direction, considerable division of authority exists, especially with respect to use of adjacent lands. Action by Congress as recommended by the Commission would provide a much needed direction to State action toward establishment of a consolidated policy, or the national sea-grant program as it exists now should have prime responsibility for the management structure for the coastal zone.

I further strongly endorse the recommendation of the Commission that coastal zone laboratories be established in association with appropriate academic institutions to engage in scientific investigation of estuarine and coastal processes and to be prepared to advise the States in managing the estuaries and coastal zones. This recommendation is actually contained in chapter 2 of the Commission report, but is referred to in chapter 3, and certainly is required to attain the goals of effective management of the coastal zone as outlined in chapter 3.

The Commission further recommends that the National Oceanic and Atmospheric Agency should have prime responsibility to provide institutional support for the coastal zone laboratories, and I endorse this recommendation.

There is a relatively short time connection between the findings of basic research in the estuarine and coastal marine environment and the application of these findings to management of this environment. For this reason I consider it essential that a close relationship exist between such coastal zone laboratories, with their base within academic institutions, and the central management agency for the coastal zone.

There is at present insufficient communication between the scientists engaged in basic studies of the physical, chemical, geological and biological processes in the estuarine and coastal waters and the applied scientific and engineering personnel responsible within the State agencies for supplying the technical basis for management decisions. I envision the coastal zone laboratories as a means of providing a close working relationship between the research scientist and the management agency.

Speaking now strictly as an individual, without any indication of concurrence by the other members of the Committee on Oceanography of the National Academy of Sciences, I would like to briefly comment on the subject of the structure of the proposed centralized Federal agency for administration of the nonmilitary Federal activities in ocean science, engineering and utilization.

I recognize that Congress must view with some frustration the fact that the scientific community, as represented by the several groups which have provided testimony on the Commission Report, has not provided either wholehearted endorsement of the specific structure recommended by the Commission or endorsement for an alternate restructuring of the Federal agencies. I do not believe that the marine scientific community as a whole can reach a consensus on this matter. In many cases the problem of administrative structure falls outside the areas of competence of the scientist.

Of more importance is the fact that the recommendations of the Commission represent the product of a very large expenditure of time by a group of competent individuals who organized the input obtained from a significant segment of those concerned with increasing our knowledge of the sea and with the use of the sea and its resources. Only after this group put a considerable effort in the digestion of this information, and in thought and discussion, did they arrive at an agreed proposal for the restructuring of the Federal agencies.

A different group of equally competent and dedicated individuals, after expending an equal amount of time and effort, would probably

arrive at somewhat different conclusions. This likelihood does not imply that the recommendations of the Commission in this area are improper. Rather it is merely indicative of the fact that there are a number of possibly equally valid ways of organizing the effort toward attaining mastery, both from the standpoint of knowledge and use, of the marine environment.

Again, I thank you for this opportunity to present these opinions concerning the national program in marine science, engineering, and utilization.

(A letter of Dr. Wayne Burt follows:)

OREGON STATE UNIVERSITY,
DEPARTMENT OF OCEANOGRAPHY,
Corvallis, Oreg., May 17, 1969.

Hon. ALTON A. LENNON,
U.S. House of Representatives, Rayburn House Office Building,
Washington, D.C.

DEAR REPRESENTATIVE LENNON: Dr. John Calhoun, Chairman of the National Academy of Sciences/National Research Council Committee on Oceanography, wrote to you on May 13 summarizing the Committee's views on the Report of the Commission on Marine Science, Engineering, and Resources.

I wish to take this oportunity to speak up for the Commission's recommendation that *the advancement of understanding of the planetary oceans be established as a major goal of the national ocean program.* This recommendation, along with several others, was endorsed by the Committee on Oceanography in Dr. Calhoun's letter to you.

The solution of every applied problem concerning the ocean depends upon our knowledge of the fundamental processes going on in the oceans. Thus the rapid growth of our fund of basic knowledge must be assured as a first step in any major ocean program. The nation cannot economically sustain an expanding program of exploitation of the ocean resources without a sound knowledge of what is there, how it changes, and the interrelationships between the factors involved.

Perhaps some of the most important missing links in our knowledge of the oceans have to do with underwater weather and climate. The primary driving force of our oceans and the atmosphere is heat from the sun which is first absorbed by the oceans and then returned to outer space via the atmosphere. Irregular changes in the rates and routes of this heat as it moves about in the oceans and the atmosphere control the driving forces which establish and regulate our climate and weather, both in the oceans (water) and in the atmosphere above. There is strong evidence that changes in the heat storage of the tropical Pacific Ocean presage mid-latitude weather changes. As our understanding of these relationships builds up, we are getting closer and closer to the day when long range weather forecasting will become a reality. We should be able to forecast six months to a year in advance when warm water will bring good tuna catches off Oregon and Washington, or when any part of the United States will be substantially warmer, wetter, or colder than normal.

Many other examples could be cited where basic research today will have practical results tomorrow, and some are referred to in the Commission reports.

Very truly yours,

WAYNE V. BURT,
NAS/NRC Committee on Oceanography.

Dr. CALHOUN. Mr. Chairman, we had hoped to have another member of our Committee with us, Dr. Wayne Burt of Oregon State University. He was not able to be with us, but he has addressed a letter under date of May 17 to you, and it is available for the record, and I would like to have it introduced.

He speaks specifically to the need for ocean science. But since it covers much of the same ground that we have covered, I won't bother to read it.

Mr. LENNON. I ask unanimous consent that immediately following the statement just made by Dr. Pritchard there be inserted the statement.

Mr. CALHOUN. I would like to comment briefly on about three other points.

The Commission report makes some very definite recommendations with respect to laboratory structure, university national laboratories, and coastal zone laboratories, which were referred to in part.

The Committee on Oceanography supplied Dr. Lawrence, in a letter to which I referred, its views on laboratories and laboratory structure, and they are quite parallel to the Commission's recommendations. We believe that the format which the Commission lays out is a very appropriate one. We would emphasize that these need to be tied in very closely to universities, as Dr. Pritchard has suggested.

We think the subject of facilities is also an important one, and we believe that, just as it takes special facilities to carry on research in medicine with hospitals, so it takes special facilities to get into the ocean environment. And these facilities are not just ships. They are buoys; they are submersibles; and they are shore facilities.

We feel as a committee that the whole area of facilities has been underfunded, and we strongly support the recommendations of the Commission in this direction.

So far as the sea-grant program is concerned, we also are generally in concurrence with the Commission's recommendations. As a committee we wholeheartedly support the sea-grant program and recognize it as a new thrust that has great meaning for the whole subject of marine resources and oceanography.

Mr. LENNON. Have you finished, Doctor?

Dr. CALHOUN. Yes, sir. That finishes our statements.

Mr. LENNON. May I turn to Dr. Pritchard?

Dr. Pritchard, there is such an organization known as the Council of Oceanographic Laboratory Directors, of which, I believe, Dr. Pritchard, you are the spokesman.

Dr. PRITCHARD. Yes, sir.

Mr. LENNON. This Council of Oceanographic Laboratory Directors responded to an inquiry made by myself to the staff respecting the position of this particular organization on the Commission's report; is that not so?

Dr. PRITCHARD. That is right. We have met on this issue, and under date of May 19, 1969, I addressed a letter to you, sir, giving very briefly the conclusions of the Council of Oceanographic Laboratory Directors.

Mr. LENNON. You identify this council by saying that it "consists of the directors of the following major oceanographic institutions of the United States." I will ask unanimous consent, gentlemen, that there be inserted in the record following Dr. Pritchard's statement the letter addressed to me signed by Dr. Pritchard for and in behalf of the Council of Oceanographic Laboratory Directors.

I ask you at some future time to read it, because it is right on the point.

Dr. PRITCHARD. Thank you.

(The letter referred to follows:)

THE JOHNS HOPKINS UNIVERSITY,
Baltimore, Md., May 19, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, House of Representatives, Longworth Office Building, Washington, D.C.

DEAR CONGRESSMAN LENNON: The members of the Council of Oceanographic Laboratory Directors appreciate this opportunity to comment for the record on their reactions to the recently published report of the Commission on Marine Sciences, Engineering and Resources. This council consists of directors of the following major oceanographic institutions of the United States:

Dr. Jonh Byrne, Department of Oceanography, Oregon State University.
Dr. Maurice Ewing, Lamont Geological Observatory, Columbia University.
Dr. Paul Fye, Woods Hole Oceanographic Institution.
Dr. Richard A. Geyer, Department of Oceanography, Texas A&M University.
Dr. John Knauss, Graduate School of Oceanography, University of Rhode Island.
Dr. W. Nierenberg, Scripps Institution of Oceanography, University of California.
Dr. Donald W. Pritchard, Chesapeake Bay Institute, The Johns Hopkins University.
Dr. M. Rattray, Department of Oceanography, University of Washington at Seattle.
Dr. F. G. Walton Smith, Institute of Marine Science, University of Miami.
Dr. George P. Woollard, Institute of Geophysics, University of Hawaii.

The directors have given this report serious study and consideration. We agree in principle with the conclusions and the recommendations submitted with respect to the action required to meet the urgent and growing demands incumbent upon oceanographic institutions. These must be implemented if the marine resources of this Nation are to continue to be developed in a manner befitting the national interest. We are becoming increasingly concerned with the level of support given to oceanographic institutions during the past several years for reasons documented in previous testimony submitted to your Committee. If the present essentially level funding to the institutions that has existed over the past several years is continued, it will become impossible for them to meet their fundamental commitments to the Nation. These include supplying the necessary basic information and pure research results that are imperative as a foundation for solving problems in oceanography, in such areas as defense and the development of marine resources. Simultaneously, the institutions will not have the capability in terms of ships, staff, and shore based facilities to train adequately the ever-growing numbers of highly qualified graduate oceanographers required to implement the expanding programs. These programs are essential to develop our marine resources and to solve defense problems vital to our Nation.

It is for these reasons that we specifically endorse the Commission's recommendations in the following areas:

1. The concept of a National Oceanographic and Atmospheric Agency to serve as a major focal point on which to build the expanding National Oceanographic Program necessary to the Nation's interest.
2. The concept of supporting a series of University/National Laboratories so that the goals and objectives suggested for them by the Commission be achieved.
3. The concept of strengthening existing and adding new Coastal Laboratories in numbers sufficient to solve the many pressing problems of immediate urgency existing now in the coastal and estuarine zones of the United States.

The highlighting of these three recommendations is not to be construed that many others in the Report, particularly those closely relating to these areas, are not also of prime importance to the total National Oceanographic Program. These were selected at this time because of their extreme pertinence and urgency for implementation. The mechanism must be provided soon to carry out satisfactorily these recommendations, with all their implications; otherwise it will become virtually impossible to expect that the Nation will be able even to meet its

minimum commitments as a major maritime state, much less to permit it to assume the position of leadership in the oceanographic community of nations that it so justly deserves.

In conclusion the members of the Council of Oceanographic Laboratory Directors stand ready at any time to provide either individually or collectively any additional material that might be required by your Committee to justify or elaborate upon the statements made in this letter.

Sincerely yours,

D. W. PRITCHARD,
(For the Council of Oceanographic Laboratory Directors).

Dr. PRITCHARD. Mr. Chairman, I just might comment that the chairman of the Council of Oceanographic Laboratory Directors, Dr. Richard Geyer, director of the Department of Oceanography, Texas A. & M., as a member of the Commission, could not, of course, respond to your request. And at the request of the remaining members of the Council, I responded on their behalf.

That is why this is not signed by the chairman of the Council of Oceanographic Laboratory Directors. I thought that might take a little explanation.

Thank you.

Mr. LENNON. Thank you, Doctor.

Now, gentlemen, I suggest that when we question the witnesses that I recognize each one of you and you select any one or all. I don't know how to tell you to get started.

Mr. GOODLING. Mr. Chairman, may I ask one question out of order. I trust the question is not out of order.

I have an appointment that I must keep. I have just a very short question, if I may proceed.

Mr. LENNON. If you are leaving as soon as you finish, I will say, yes, go ahead.

Mr. GOODLING. First of all, I think I should welcome Dr. Calhoun here as a fellow Pennsylvania University man.

Dr. CALHOUN. Thank you.

Mr. GOODLING. This is my question. It is very timely and may not be relevant to what you are talking about right now but to me it is very important.

Would you care to comment on the proposal of DOD to dump gases into the Atlantic Ocean?

Dr. CALHOUN. I don't belive I care to comment, sir. I don't believe I have the total background on the subject.

Mr. GOODLING. That is all, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Goodling.

Now the gentleman from Ohio, Mr. Mosher.

Mr. MOSHER. Mr. Chairman, it seems to me that Dr. Calhoun and his colleagues have presented for us this morning a most impressive case in support of the Stratton Commission's recommendations, particularly the recommendations for reorganization of the agencies and the creation of a new central agency to take the lead in the uses of the seas.

To me, Dr. Calhoun, your arguments are very cogent, very forceful, very convincing.

I noticed in your letter to Chairman Lennon on page 3 of your printed statement that you emphasize that the comments contained in

that letter were made before the panel reports of the Commission became available. Now the panel reports of the Commission are available, and I assume that you and your associates have had a chance to study them. Could I also assume correctly that those panel reports only reinforce the position you took in your letter to Chairman Lennon? They do not in any way detract from your enthusiasm for the Stratton Commission's report?

Dr. CALHOUN. I can only speak as an individual in this respect. The Committee did not receive the panel reports prior to its last full scheduled meeting, so we have not discussed in Committee meeting the panel reports or their contents.

I have read parts of the panel reports. I haven't had time to go through them in detail. Generally speaking, yes, they do reinforce my feeling on this matter and do not detract from it in any way. I don't know if any of the other NASCO members here have a comment. Dr. Pritchard says that he concurs. Yes, there is general agreement among us on that point.

Mr. MOSHER. As I sense it, the major emphasis in your comments today is on the need for, to use the phrase you use, a manifold increase in the level of effort in the areas we are discussing here.

Now, there has been some criticism of the Commission's report that it is too modest. Do you have that feeling? The criticism is that it is too modest as to what it projects as to the level of funding in the next 10 years. Does it meet this standard that you are suggesting for a manifold increase in the level of effort?

Dr. CALHOUN. I don't recall the specific dollar figure that the Commission proposed, and I have not made a comparison. As I recall the figures, I would say that what the Commission recommends would be a manifold increase.

Mr. MOSHER. In other words, you do not necessarily think it is modest.

Dr. CALHOUN. "Modest" is a relative term, and, as I say, I don't remember the specific figure. I don't have the report in front of me.

Dr. PRITCHARD. Mr. Chairman, while Dr. Calhoun is refreshing his memory, I might say, as an individual, that I found this possibly the one drawback in the Commission's report that I felt concerned about. In its efforts to perhaps be practical the Commission did not really project the growth needs and the goals that it stated properly in terms of the financial needs.

Mr. MOSHER. In other words, your recommendation to us would be that the Congress could look upon the recommendations as modest and not be tempted to look for goals that were less than the Commission's report.

Dr. PRITCHARD. Definitely. I feel that, while the Commission has properly outlined the Nation's goals and what we should do in the future, these are not reflected fully in the dollar amounts that they quote.

Mr. MOSHER. Now, Dr. Calhoun.

Dr. CALHOUN. Just having gone back to look at the way they have this figure laid out, it is not up to the figure that we indicated in our letter to Dr. Lawrence of something less than $5 billion a year or something more than $1 billion a year.

Mr. MOSHER. That was my impression.

Dr. Calhoun, on page 10 you use this sentence: "We do not need a modified management structure so much to coordinate and correlate the things being done now as to undertake the things that are not being done."

I am glad you remind us of that.

On another page in your report, among the things that you emphasize are not being done, I think you indicate that in our present situation we have no focus or center of initiative in the comprehensive development of fundamental technology in the uses of the sea.

Would you agree with me that that emphasis should be of the very essence of our planning for a reorganizational structure, for the creation of a new agency, that there is a very basic need for technology development that we are not meeting under the present situation?

Dr. CALHOUN. Yes; I would agree.

One of the things I tried to say in my statement, although I realize I didn't say it very well, is that in your deliberations for structuring a new agency the most important thing to be asked is, what specific missions will this agency be called upon to do?

In my view—and I think it is shared by the members of the Committee on Oceanography—that principal mission should be to learn to work and do things and carry out activities within the ocean—to develop, if you will, a technology which does not now exist for the civilian economy.

In order to develop this technology, it will be necessary to do a reasonable amount of basic research and gain further understanding of the environment itself. But it will be necessary to go beyond that into many project-level activities and task-force activities which actually get down to the business of doing something that isn't being done now.

So I think we are in agreement.

Mr. MOSHER. That mission is really not located or focused in any present agency.

Dr. CALHOUN. I don't think it is.

Mr. MOSHER. That is all, Mr. Chairman.

Mr. LENNON. Thank you, sir.

Before I recognize the gentleman from Minnesota, I just want to get something for the record to be sure that I understand it, Dr. Pritchard.

The Council of Oceanographic Laboratory Directors, how many colleges or universities does that represent, this council?

Dr. PRITCHARD. Ten. The Council represents 10.

Mr. LENNON. The Council, so you state here, are "the directors of the following major oceanographic institutions of the United States."

Dr. PRITCHARD. That is right.

Mr. LENNON. What I am trying to determine, since someone has raised the question, is: Are there not other institutions at this same university level which are also members of this Oceanographic Laboratory Council?

Dr. PRITCHARD. No, sir. There are 10 directors of 10 institutions who got together and formed the Council of Oceanographic Laboratory Directors. These were laboratories which had the following major features in common. They operate oceanographic research vessels in the open ocean and have a significant research program, as well as in many cases a teaching program, in this field.

Mr. LENNON. That answers my question raised by another member.

Dr. PRITCHARD. There are other marine institutions, many of which do not operate oceangoing vessels.

Mr. LENNON. That answers the question.

Now the gentleman from Minnesota.

Mr. KARTH. Thank you, Mr. Chairman.

Dr. Pritchard, isn't it extremely difficult to calculate with any reasonable degree of accuracy what a program in line with the Commission's recommendations would cost, not really knowing what basic and applied-research-and-development programs would be initiated?

I don't mind the criticism that you aimed at the Commission's report in terms of its elusiveness in its report. But I think it is difficult to pinpoint these things.

Dr. PRITCHARD. I would agree that it is extremely difficult to forecast.

Mr. KARTH. And that perhaps is why it was difficult for Dr. Calhoun to be more specific. He says less than $5 billion and more than $1 billion. That is quite a variation, too.

Dr. Calhoun, how much money was appropriated to the National Academy of Sciences last year insofar as it relates to marine-resources activities?

Dr. CALHOUN. I was going to ask the secretary of the committee. He says our budget for the committee was about $85,000 last year. This money is not appropriated to the Academy, however. We have working agreements with a number of individual agencies which support our activity.

Mr. KARTH. Could you be more specific? What agencies are involved?

Dr. CALHOUN. The Bureau of Commercial Fisheries, the National Science Foundation, the Coast Guard, the Atomic Energy Commission, ESSA, and Navy.

Mr. KARTH. That is all, Mr. Chairman.

Mr. LENNON. Mr. Pelly.

Mr. PELLY. Thank you, Mr. Chairman.

Dr. Calhoun, I recognize that as a member of the scientific community you are somewhat hesitant to comment in detail on the structure of a Government agency, but I think perhaps Dr. Paulik could comment in this since I note that he has been a consultant to what I call a unilateral arrangement for conservation; namely, the Inter-American Tropical Tuna Commission.

I am addressing myself more to the problem of fisheries because I happen to be on the Fisheries Subcommittee and am concerned in one particular respect with how the fishery problem is going to be solved under any new agency.

It seems to me that we are more and more getting into the realm of international agreements so far as fisheries conservation and self-protection is concerned. We have arrangements on the Atlantic with the Soviets. We have them with the Soviets on the Pacific. We have an agreement with the Japanese; and we have certain international arrangements for halibut with the Canadians, and so forth.

So it appears that now, while we only produce 4 percent of the world's supply of fish and consume some 12 percent, we are more and more reaching out into the realm of international agreements and the

State Department is directing more of its attention to the fishing problems of the United States today than is our Bureau of Commercial Fisheries.

I indeed wonder how we can protect our fishing industry and our fishermen and their livelihoods under these conditions, and if we create a department or agency which has oceanography and basic research and all the other matters that come within marine science, how we are going to get the State Department into this picture without letting them run away with the ball?

Dr. Paulik, you said in your statement that you confessed less personal enthusiasm for the Commission's recommendations concerning international fisheries affairs. Could I get you to comment on the basis of what I have said?

Dr. PAULIK. I think I also said that these problems are enormously complicated.

Mr. PELLY. In Peru, today, we are finding that out.

Dr. PAULIK. I was reacting to the Commission's specific recommendations for an overall catch quota of cod and haddock in the North Atlantic. I feel that such a quota is far too simple a solution for a problem of this complexity, involving several different stocks of fish. The real problem is to limit in some way the total fishing effort in the North Atlantic.

I support the Commission's recommendations for strengthening and extending our bilateral and multilateral agreements. Some of these have worked very well.

Mr. PELLY. Halibut is an example.

Dr. PAULIK. Yes, sir.

Mr. PELLY. In the establishment of a new agency we are going to have to recognize that the State Department will play a very prominent role in all matters having to do with research and conservation and indeed the protection of our own industry.

Dr. PAULIK. Yes. I don't think that a new ocean agency would in any way detract from the role of the State Department. In fact, I think such an agency would enhance the State Department's role by providing a much sounder base of factual information for their recommendations.

I think many of our present difficulties arise from mutual misunderstandings and suspicions of different nations. If we had a sounder base of knowledge, it would be simpler to reach more equitable agreements in the international area. Where agreements are not reached, it is likely we will destroy the resources to the detriment of all the participating parties. I think that strengthening our scientific capability in these areas would provide the State Department with the ability to recommend programs which would function perhaps better than those we are working under today.

Mr. PELLY. Under agreement with the Soviet Union we have mutual arrangements for research and we have found out for example on the Pacific that the supply of perch is dangerously low and we were able to reach agreement with the Soviets that they will not take perch. These are things that I want to satisfy myself are going to go on in spite of any new agency that is set up. You think it could be actually improved?

Dr. PAULIK. I certainly hope that it would not only go on, but that we would improve our ability to make these agreements with other nations. I think the Commission's report supported this type of activity very strongly. They recommended that many of the international agencies have their own scientific staffs patterned after the Inter-American Tropical Tuna Commission, the Pacific Halibut Commission and the Pacific Salmon Fisheries Commission.

Mr. PELLY. Of course, I think we all recognize that we do have a very able man in the State Department in Dr. Donald McKernan.

Dr. PAULIK. Yes.

Mr. PELLY. I don't know, frankly, what we would do without him.

Dr. PAULIK. We are very fortunate.

Mr. PELLY. We can't expect to always have a person that has as good a background and is trained in science as well as the practical aspects. I think maybe you have answered me. I want to think about it a lot and I would like any other comments.

Dr. CALHOUN. I would like to respond briefly to the first comment you made. It isn't that I, as a scientist, am unwilling to talk about organization. As a scientist I have opinions on many things. I simply don't want to present an organization question as a scientific matter, and we were trying to make the point that as scientists we all have varying opinions on this.

Mr. PELLY. A political-scientific question.

Dr. CALHOUN. I would say this as a personal observation. My own views are that it is very important that any organizational structure be done at the highest level. This is why I have expressed myself personally as being in favor of a major reorganization somewhat akin to the reorganization we made with the Department of Defense.

I personally would opt for creating a new Department of Resources and Environments, one unit of which would be a subdepartment on oceans and atmospheres. This is only a personal view.

I think it is time, however, that we gave to some top-level person in the executive this responsibility and let him reorganize the units in a way that would get the job done just as we did in the Department of Defense. They created in Defense an Office of Defense Research and Engineering, which supports the whole establishment.

It seems to me that if we had a Department of Resources and Environments, the Secretary of that Department could create a similar internal structure, an Office of Environmental Resource Research and Engineering. Congress wouldn't have to tell him how to organize it. They would tell him to get on with doing the natural resource job, one part of which is the oceans.

Mr. PELLY. I think you are a good political scientist, Dr. Calhoun, because I think you have offered a very practical way in which this could work very efficiently.

Dr. CALHOUN. Of course this is predicted on the assumption that within our total executive we have too many units, and this is why I personally in all my testimony have not used the word independent in talking about a new agency. I think we have too many individual agencies, and I would rather see some consolidation. So, if we make a bold move like we made when we put the Department of Defense together, and get all of these questions coming up with respect to resources and environments and put them in one package under a Secretary and tell him to get on with the job, we wouldn't have to

argue about whether we are destroying a subagency or not. You would leave it to the best judgment of the people running the Department to get the job done.

Mr. PELLY. The word "independent," as far as agencies go is probably the most overworked and greatly exaggerated word there is because there is no such thing as an independent agency that I can find. It all goes back to the Bureau of the Budget.

Mr. MOSHER. Would the gentleman yield?

Mr. PELLY. Yes.

Mr. MOSHER. I would like to ask a quick question of Dr. Paulik. A constituent of mine was arguing with me the other day and he was defending the position of Peru in the argument over the fisheries, and he claimed that the American fishermen in those waters were taking catches of species that are prohibited to the Peruvian fishermen under their own regulations; in other words, that this is one basic reason for Peru's action. Is there any truth to that?

Dr. PAULIK. No, I don't believe there is any truth to that statement. As far as I know we are taking only tuna in those waters, and Peru is not harvesting these tuna resources.

I think Peru is concerned about their anchovy fishery which is extremely large and is a very important part of their economy. They may also be concerned about protecting some planned future entry into the tuna fishery.

Mr. PELLY. I am glad I yielded to the gentleman on that subject because it gives me an opportunity to say that they have seized practically every one of our boats, several times using our own naval vessels to do it, and never charged that they found anything but tuna on them. All they wanted to do was fine us anyway.

Mr. LENNON. It is interesting to observe at that point that in February 1959 the Committee on Oceanography of the National Academy of Sciences issued its catalog with its introduction and summary of recommendations, and it was because of this document that this subcommittee was formed by the Committee on Merchant Marine and Fisheries. You gentlemen are responsible, in fact—not speculation—responsible for the bringing into being of the Subcommittee on Oceanography of this committee. We are delighted to have you back home again.

Dr. CALHOUN. I will have to yield to predecessors on this point.

Mr. LENNON. Now the gentleman from California.

Mr. HANNA. Thank you, Mr. Chairman.

I particularly want to note that Dr. Pritchard appears here as one of the local boys who made good. I represent Santa Ana, where the gentleman was born. I am delighted to have you here before the committee.

Mr. Chairman, I was particularly struck by a statement by Dr. Calhoun in which he said, "In all affairs of men there comes a time to act." And it brought me back to a situation in law school in which the professor had us working on one case for about a week trying to analyze why the judge decided, and after we had given him all of the intricate reevaluations of that puristic mind, he finally said, "I think you are all wrong. He decided it because the case had to be decided."

I think that is the kind of situation that we are ultimately in and we will have to establish our role somewhat in a mix of what I understand from the story of three umpires who had been through the season and were meeting together and decided to exchange views on

how they decided to call balls or strikes, and one who was a little younger had a modicum of humility left and a substantial amount of moral rightousness, and he said, "I call them as I see them." The other fellow who had been a little more experienced and therefore had far less humility and a little more authoritarianism, said, "I call them as they are." And the third fellow who was the senior of the umpires there had already reached the place where the deistic mantle settled over his shoulders said, "I figure they ain't nothing until I call them."

Somewhere in the mix there is where this committee is going to have to be in deciding what the structure is going to be. I don't know that we are going to have any more humility than is generally expressed by persons who have had experience in their callings because I noted in several of the statements of the gentlemen the general course of those who have been acting long enough to have not been overtaken by humility. I find that in the statement saying, "We look with longing upon this new environment to conquer" and in the statement, "There are a number of possibly equally valid ways of organizing the effort toward attaining mastery * * * of the marine environment."

Conquering and mastery, it seems to me, shows a rather lack of humility which the western man has exhibited in an exorbitant capacity throughout our history. I should like to see that subordinated a bit. I think we are at a place where humility might be brought to play here, and I would prefer to see us looking at this thing as though we were part of nature rather than an adversary to nature.

I understand the background in which we have come to be a highly competitive adversary type people, and I make this point, Mr. Chairman, because it establishes the kind of attitude we have as we set about this job, and I think the time has come when western man has to reevaluate his attitude and I hope that our attitude would be a little different than the assault and mastery we have made on land, over our forest industry, for instance, and the conquests that we have made in our rivers.

Would you care to comment on that?

Dr. CALHOUN. Yes, I think this simply shows the inadequacy of words when one is trying to present the best possible face and the most forceful argument.

I do think it is a time to act and I guess I used the word conquest like the colonialists and imperialists of old in the best sense of the word. But, I might say I agree with your observations. This is one reason why in my own thinking I would advocate, as I said, an Executive Department of Resources and Environments. And, I put the two words together for this very reason—that whatever we do must be done recognizing that we, too, live on a spaceship and the spaceship is rather limited. If we don't pay some attention to its characteristics, we are likely to find that we, too, are lost in space.

Mr. HANNA. Would you care to comment on that, Dr. Pritchard?

Dr. PRITCHARD. Yes, since the one quote was as to mastery, I agree that it would have been more appropriate to have stated something to the effect that we should attain an ability to exist within the environment, within the natural environment.

Mr. HANNA. Some kind of a harmonious——

Dr. PRITCHARD. Harmonius existence within the environment we live in. To understand them takes knowledge and that was really my main emphasis.

Mr. HANNA. I understand.

Dr. PRITCHARD. If we are to exist in a compatible situation with the ocean, we have to know its processes and forces and be able to not necessarily master them, but to direct them perhaps to avoid such things as destruction and to take advantage of the currents for a more rapid transit and such things as that.

Mr. HANNA. I hope you gentlemen won't think I was being forcefully critical. I wanted to make a point, and you have helped me make it, and I think it is important that that point be constantly before us so that we do not relive some of the errors of the past and that we have more of the ecological thought in this thing at all times.

I think that you gentlemen have contributed very substantially to this whole decisionmaking process with what you have said.

I think, Mr. Chairman, that it is only fair to tell these gentlemen that it is going to be easier for Congress to tell the executive what to do than to face up to what Congress has to do.

Other than that, I want to commend each of you for your contributions here this morning.

Mr. ROGERS (presiding). Thank you very much.

Mr. Keith.

Mr. KEITH. Thank you.

As I listened to Dr. Calhoun, I thought of him not only as an accomplished oceanographer, but one who might also have earned his doctorate in English or perhaps in management, and then, as it finally has developed, in philosophy. It has been a rare privilege to be here. When I came to Congress, I had quite a financial burden, but I used to think it was compensated for by the educational experience. Today has been a graduate course in that, and I am very grateful for your contribution.

We have an expression in New England, "It is time to fish, cut bait or pull for shore." And I think, from the tenor of this committee and the witnesses before it, that we are going to try to do just that.

I have one question, and it may be best to develop this if you are going to be in town a few hours, Dr. Paulik. I represent the city of New Bedford, and we are very much concerned not only about lobster, scallops, and many other species of fish, but more particularly haddock, which hasn't been a big product in our port.

If the projected plans of the ICNAF materialize, haddock may be in very short supply. This means that Boston fishermen are going to transfer into New Bedford products. You talked at some length in your report or in your prepared statement, as well as afterward, about what was wrong, but you didn't say what you would do about haddock.

Now, if you have a short answer to that, I would like to have it here. If you have a long answer, I would like to meet you later on.

Dr. PAULIK. Maybe we could defer this until the session is finished.

Mr. KEITH. Let's do that, because there is another witness from the private sector. But if you are going to be in town for another 3 or 4 hours, I would like to meet with you.

Dr. PAULIK. I will certainly be at your disposal.

Mr. KEITH. That is the only question I have, Mr. Chairman.

Mr. LENNON (presiding). The gentleman from Florida.

Mr. ROGERS. Thank you very much, Mr. Chairman.

I have had an opportunity to look at your statements and have been impressed with your feelings and think your viewpoint has been most helpful to the committee.

Dr. Calhoun, I notice that while you give some viewpoints, you make the statement, "In no way should our remarks be attributed to the National Academy of Sciences," but you are on a committee of the National Academy of Sciences, are you not?

Dr. CALHOUN. Yes.

Mr. ROGERS. But you don't want your viewpoint to be associated in any way with the Academy?

Dr. CALHOUN. We don't speak, in this sense, for the Academy and there is a limited area in which we can speak for the Committee on Oceanography—that where we have a consensus of opinion. The things that we did agree on we have tried to state in the letter to Mr. Lennon.

Mr. ROGERS. In the three points.

Dr. CALHOUN. That is right. My prepared statement is my best interpretation of how I think the committee might feel. And, as you have heard from these gentlemen, we do have a general agreement about the matter, but we speak really as individual scientists who have come together with common purpose. Our majority opinions and considered viewpoints generally show up in our reports and these are on record.

Mr. ROGERS. I see. Thank you so much. It has been very helpful.

Mr. LENNON. Doctor, I believe you sum up the position of NASCO relating to the governmental structure in these words which are found beginning on line 8 on page 12: "However, we should be more concerned with what needs to be done than with whether an existing agency should be maintained intact."

Is that the philosophy of the NASCO?

Dr. CALHOUN. That is certainly one way to summarize it.

Mr. LENNON. Did you summarize it that way?

Dr. CALHOUN. It takes my whole statement really to summarize and taking one sentence out of context sometimes can get you in trouble, but I would say that is one way of summarizing it. We might offer a few guidelines. When it comes to an existing agency, one has to ask whether the mission of that agency can be carried out if you don't give it access to the ocean. And, just because it is doing some ocean-related work doesn't necessarily mean that you ought to take the agency and plunk it into a new organization. You have to ask yourself why is it doing ocean work.

Mr. LENNON. Take the agency Coast Guard with its mission of search and rescue.

Dr. CALHOUN. The Coast Guard happens to be an agency which is oriented almost completely to the ocean. Let's take the Geological Survey, for instance.

Mr. LENNON. Let's hold right where we were. You concede then that the Coast Guard in its missions and roles is oriented almost entirely to the oceanic environment?

Dr. CALHOUN. Yes, sir. I think that is a fair statement.

Mr. LENNON. Should that agency be placed in the new proposed Federal agency as recommended by the Commission report?

Dr. CALHOUN. Well, Mr. Chairman, the decision as to what agencies ought to be in the new structure——

Mr. LENNON. I am not asking for a decision. I am asking your judgment and opinion.

Dr. CALHOUN. I think it would be most appropriate for the Coast Guard activity to be a part of a focus agency to develop ocean science and technology. There are parts of the administrative structure in any technological development which don't move so much to the development of the technology itself as it does to protecting the public. I think we have some good examples of this in the health field where we divorce the regulatory and safety regulations from the mission of those who are developing the technology.

In the atomic energy field we handle it a little differently, but again there are regulatory agencies that are protecting the public and are looking after the safety of people which is different from the development of the technology.

These things are joined always in any technological development, but I think it is a matter of governmental administration to recognize that there are safety problems and human involvement problems that are separate and distinct from the development of the technology. Just because both happen to be concerned with the same environment doesn't necessarily mean that administratively you put them together. It depends on the checks and balances that are needed.

Mr. LENNON. What about the Environmental Science Services Administration which the Commission recommended be put in this new agency?

Dr. CALHOUN. It seems to me that one question that has to be asked is whether the mission of an existing agency is broader than ocean science and technology and specifically with ESSA this is a question that I would have to ask myself.

It seems to me that the mission of ESSA goes beyond ocean science and technology. If one is structuring a new agency that has a mission in ocean science and technology, then you have to ask what do you do with an agency whose missions are broader than ocean science and technology. Do you put it in or leave it out? That is the kind of question you have to ask.

Mr. LENNON. You have contractual relations with ESSA, Coast Guard, and many others. You would be working with these Government agencies in the field of sciences. Who would be in a better position to make an administrative determination as to which could be brought together?

We work with them only in the legislative aspect. You work with them down in the issue in which they are involved. Where should we go to get definitive advice and information with respect to what agencies should be brought together that have roles and missions so oriented to marine technology, oceanography, oceanology, and marine sciences other than people like you?

Dr. CALHOUN. Again, our contact with these agencies is from a program point of view.

Mr. LENNON. I understand that, but you get to know them and know what their programs are and why.

Dr. CALHOUN. Well, in answer to your question, sir, I think that this is again a reason why in my own personal judgment I come back to the point that it is so important to designate to some executive a responsibility for resources and environments and let that administrator organize internally to take care of these overlaps. There isn't any way that one can organize any activity to get around overlaps. There are always going to be some.

Mr. LENNON. With that I agree. We would be delighted to hear from you, Dr. Pritchard.

Dr. PRITCHARD. Thank you very much, Mr. Chairman.

I might perhaps be willing to speak a little more directly than Dr. Calhoun. I would say this: The problem is that existing agencies are not structured necessarily appropriately from the ocean standpoint. That is we have a number of existing agencies whose mission encompasses broad aspects of the environment including the ocean and so to consider how to put these agencies together in an ocean-oriented system is difficult.

You can say, "Well this one has more ocean orientation than not, so we will put it in, but this one, while it has a significant amount of ocean-oriented activity, has a larger activity associated with land, and we won't."

This is one reason why I would again support Dr. Calhoun's suggestion that, if one didn't have to just assemble the agencies into a single structure which were ocean-oriented but could assemble the agencies which are concerned with natural resources and environment, and leave them a larger structure, and can now shuffle within these agencies a group of activities which are ocean-oriented, thus we accomplish the purpose.

It is hard to see how to put this jigsaw puzzle together when the pieces don't quite match now is the point I make.

Mr. LENNON. We would be delighted to have the recommendations of the Oceanography Committee of the National Academy of Sciences in the form of suggested draft legislation. We would be delighted to consider it and see what you folks really believe.

Dr. DRAKE. May I comment on this, too? In my specific field, which is geology and geophysics, the division as proposed is not quite appropriate because the rocks don't really know whether they are underwater or under the air. I would endorse most highly Dr. Calhoun's recommendation that the idea of an agency dealing with natural resources and environment should be considered.

Anytime you try to split up the environment, you get into trouble because, for example, one man's solution to a pollution problem is another man's pollution.

Mr. LENNON. One man's solution is another one's pollution. All of us find ourselves in that situation.

Dr. DRAKE. As soon as you divide up environment into separate jurisdictions, one man will take his pollution out of the water and put it in the atmosphere, or another takes it out of the atmosphere and pumps it underground. In each case you are not really solving the problem. You are just putting it into another jurisdiction.

So I would endorse the idea of trying to draw these things together into a single agency.

Mr. ROGERS. Would the gentleman yield?

Mr. LENNON. I will be delighted to yield at this point.

Mr. ROGERS. It seems to me that we are losing somewhat the thrust of what we are trying to do. What we were trying to do in setting up the Commission to make a study on oceanography is trying to emphasize the development of resources in the sea and its associated resources.

Now, we are trying now to consider an agency to bring that to the

forefront. We have had Interior. We have had a lot of the land development. We have had the Weather Bureau with emphasis on the land, and so forth. We are trying now to bring in the oceans.

I understand your concept of saying all of this ought to be tied together, and I am sure everyone would agree, but we are not quite at that stage probably. I think we have to upgrade our handling of oceanographic problems in the national budget, in national emphasis, in national programs before we can ever talk about equalizing.

Otherwise we start now and you still have downgraded oceans if you are going to put it in an environmental department where the oceans have never been upgraded. This is what we are trying to do, and I think we have lost the thrust of the whole effort in developing oceanography.

Dr. DRAKE. That is a point.

Mr. ROGERS. I think it's a major point.

Dr. Drake. If you look at the Commission report, you run into the same thing. They started to study the oceans. They found they really couldn't do this without including the atmosphere.

Mr. ROGERS. Of course, interaction of air and sea is a proper function to be in an oceanographic agency, and the Commission as a result of that has recommended a separate agency.

Dr. DRAKE. Atmosphere and sea. I look at this from the geological point of view and see interaction with the solid earth as well.

Mr. ROGERS. Seventy percent of the earth is water, isn't it? Air and water, 70 percent. Where should interaction of air and sea be? In an oceanographic agency I would think.

Mr. LENNON. Gentlemen, we do appreciate your presence here today, and if Mr. Beckman would confer with us here, we will determine what we will do from now on. We will go off the record at this time.

Thank you gentlemen. I am sure we will be calling on you in the future for counsel and advice. We are grateful for your attendance.

(Discussion off the record.)

Mr. LENNON. The schedule for tomorrow, which will begin of course at 10 o'clock, is Mr. John H. Clotworthy, president of the National Oceanographic Association, and Dr. Walter Orr Roberts. University Corp. for Atmospheric Research, and Congressman Bob Wilson also desires to be heard tomorrow.

Now the gentleman with whom we just discussed the matter of rescheduling, if you will meet with counsel after the meeting is adjourned, that will be done to suit your convenience and will give you an opportunity to enlarge the scope of your discussion to include comments on what you may have heard here today, and I will request that you be furnished with a copy of Captain Bauer's statement before the committee. You may want to comment on that, too.

Thank you, gentlemen. The meeting will stand adjourned until tomorrow morning at 10 o'clock, to be chaired then by the gentleman from Florida.

(Whereupon, at 12:10 p.m., the subcommittee recessed, to reconvene at 10 a.m., Thursday, May 22, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

THURSDAY, MAY 22, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:15 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Paul G. Rogers presiding.

Mr. ROGERS. The subcommittee will come to order, please.

This is Maritime Day and a number of the members had to attend ceremonies, some in New York.

We are delighted to have some distinguished witnesses with us, and the first witness we have today is an old friend and one who has taken a very active interest in this field for years, Mr. John Clotworthy, who is president of the National Oceanography Association and who is president of Oceans General, Inc.

Mr. Clotworthy, we are delighted to have you and we will be pleased to receive your testimony. If you have any associates, we would be delighted if you would bring them with you, and will you identify them for the record.

(A biographical sketch of Mr. Clotworthy follows:)

BIOGRAPHICAL SKETCH OF JOHN H. CLOTWORTHY

Mr. Clotworthy was born in Baltimore, Maryland in 1924. He graduated from the University of Virginia with a Bachelor's Degree in Electrical Engineering and has done post graduate work at the Harvard Business School. In 1967 following eighteen years with the Westinghouse Electric Corporation, during which time he rose to the position of Vice President, Defense and Space Center and General Manager of their Underseas Division, he joined the faculty of the University of Miami to become Chairman, Division of Ocean Engineering. In mid-1968 he formed Oceans General, Incorporated of which he is President.

Mr. Clotworthy is a member of the Institute of Electrical and Electronics Engineers and is a founding member and director of the Marine Technology Society. In 1963 he served as Chairman of an ad hoc committee of the National Security Industrial Association which prepared a report entitled "A National Ocean Program". He is a director of the American Society for Oceanography and President of the National Oceanography Association.

STATEMENT OF JOHN H. CLOTWORTHY, PRESIDENT, ACCOMPANIED BY RICHARD N. RIGBY, JR., EXECUTIVE DIRECTOR, NATIONAL OCEANOGRAPHY ASSOCIATION

Mr. CLOTWORTHY. Mr. Chairman and members, it is a privilege to appear today to testify in behalf of the National Oceanography Association. I have with me our executive director, Mr. Richard N. Rigby.

Mr. ROGERS. Mr. Rigby we are delighted to have you here.

Mr. CLOTWORTHY. The National Oceanography Association is a citizens' organization dedicated to a stronger national program in the oceans, consisting of approximately 600 corporate and 900 individual members.

I have submitted for the record a list of our board of directors.

The Commission on Marine Science, Engineering, and Resources has put before the country a major question—are we to have a stronger, concerted national ocean program or not?

We have been discussing, studying, recommending, and debating this question for a full 10 years. Significant actions have taken place during the decade since 1959 in response to these studies, principal among which, in my opinion, was the enactment in 1966 of the Marine Resources and Engineering Development Act for which this subcommittee is in large measure responsible and which sets the stage for present deliberations.

Now, I submit, we are at the time of decision. Do we as a Nation move ahead on a broad scale into the oceans, or do we continue to study the problem while other nations move to establish operational competence that will assure continued decline in U.S. position as a maritime nation?

The Commission report puts the case for action in brilliant fashion and with the right emphasis on the benefits to the public from such a move. The people of this Nation do have a real stake in the decision we make—our security, or economy, our ability to meet demands for food and raw materials, our position in the world community, the quality of our coastal and Great Lakes environments, our comprehension of weather systems—all will be greatly affected by the direction we choose, as the Commission report states.

It is not possible in a short period to review the Commission recommendations in detail. Nor, as the Commission itself recognized, have all of the findings and suggestions met with approval. During these hearings, there will be no doubt be recorded objections to this recommendation or that finding. No such commentary can or should be allowed to obscure or diminish the excellence of the report as the whole, the soundness of most of its conclusions and the propriety of its advocacy of a concerted national ocean effort with a strong emphasis on private enterprise.

I, and I think many in the oceanography community, have two major reservations with the work of the Commission—but these in no way lessen my respect for the excellence of the effort. First, I don't think the Commission adequately treated the significant role the U.S. Navy has played in the development of our existing ocean capabilities and the role it will certainly play in the future.

Perhaps this represents a maturing of view—a recognition that a true national ocean program is bipolar, involving a nonmilitary as well as military capacity.

Second, I think the recommendations in the field of international law dealing with undersea resources are subject to question as to whether or not they are in the best interest of this country. The Commission recommendations in this complicated legal field, along with the objections you will certainly hear, should be examined most carefully and deliberately before a choice is made or action initiated.

In this instance, the fault is too definitive a recommendation, too soon. I urge that this question be considered separately from the rest of the Commission report.

Before discussing the Commission's central recommendation to provide focus and coordination at the Federal level, I would like to submit for the record the statement adopted by the board of directors of the National Oceanography Association on January 27, 1969:

The National Oceanography Association Board of Directors endorses the unified management advocated by the Commission for Federal nondefense oceanographic efforts through formation of an independent agency—the National Oceanic and Atmospheric Agency (NOAA). We believe further studies should be made promptly with the aim of consolidating views on the appropriate size and composition of NOAA.

We heartily endorse the recommended National Advisory Committee for the Oceans to facilitate close industry-Government coordination.

We recommend continuation of the present National Council on Marine Resources and Engineering Development until decisions are reached on the recommended reorganization as suggested by the Commission.

We commend the initiative of the Oceanography Subcommittee of the House Committee on Merchant Marine and Fisheries in meeting with representatives of the Commission to discuss implementation of the report soon after its issuance.

The National Oceanography Association Board of Directors urges further study be given the recommendations of the Commission regarding international law relating to deep sea resources and specifically its endorsement of a narrowly defined Continental Shelf. We believe the United States should not attempt implementation of these recommendations prior to completion of such study.

In the interim, the U.S. should continue implementation of the principles of the Convention on the Continental Shelf.

The National Oceanography Association Board of Directors endorses the Commissions' recommendation that "concrete, definable" National Projects be established with the broad aim of advancing knowledge and technology. The private sector should participate in the planning of the projects; Congress should adopt them and provide adequate funding, subject to customary legislative oversight and appropriation reviews.

Creation of the recommended National Oceanic and Atmospheric Agency is absolutely essential to a stronger national program, in our view. Regrouping within an existing department or continuation of the present council, even with additional authority, will simply not meet the national need.

The reasons for so stating are many. If we don't take the recommended step or something very close to it, we will lose the momentum that has been built up slowly in recent years in our ocean capabilities and knowledge. We will, in fact, move backwards. You gentlemen will have a very understandable reluctance to suggest continuing the council beyond the June 30, 1970, expiration date after the two previous extensions of this interim coordinating mechanism. To my mind, the unlikely continuation of the council makes action on reorganization imperative.

The Federal organization for marine activities, as has been often observed, is fragmented, sometimes duplicative, and lacking in focus or direction.

We simply have to have a competent civilian agency with the expertise to evaluate the Nation's needs as they relate to the Federal role and with sufficient strength to carry out necessary programs approved by the Congress.

Perhaps the need for this independent agency can best be illustrated this way—who would coordinate varied civilian programs, oversee

their day-to-day operations and provide the mechanism for coordination of programs and research with the military oceanographic effort? Who in the Federal Government, now, is there to evaluate and then act on the Commission's recommendations? Who, now, would review and recommend to Congress if the recommended national project for increased test facilities is valid and, if so, to what extent Federal participation is needed or desirable? And after this examination, who would be in charge? Where would an interested company go for information? Where would students write?

These same questions can be applied to Commission recommendations for the Great Lakes restoration feasibility project, Continental Shelf laboratories project, civilian deep submersible systems, and the buoy network proposals.

It is because the Nation needs to move on these and other programs and because the national interest is involved that we need Federal reorganization.

I think it is well worth noting here that other nations are moving—in coastal zone management, Continental Shelf research and development, aquaculture and ocean engineering. Russia, France, Japan, and England, for example, are active in most of these fields today. We dare not be left behind.

Let me lay to rest the suggestion that industry is only interested in the Federal tax dollars that might flow from a new agency. While there may be some concerns looking for Federal contracts, because that is their business, there are far more who are not. As you will see from the attached list of NOA questionnaire respondents, there are industries without involvement in oceanography who support reorganization as well as those that are because of the logic of the agency proposal and because they want to see the country have a strong presence in the sea. The support from academicians and the general public is clearly not motivated by self-interest alone. There are thousands of individual citizens who are interested because they see the future of oceanography and understand the need to take action.

I commend this course to you—form the National Oceanic and Atmospheric Agency now and do not provide one dime of additional funds beyond present Federal expenditures for the components. Charge this agency with implementation of the Commission report and direct it to report to Congress with its recommendations for action, along with whatever new authorizations would be required. In my view, this is just simply good management. The Federal Government is already spending a considerable amount on civilian oceanography activities, estimated by the Commission as $773 million this year, without central control or direction.

In this age of slogans, I apologize to the committee when somewhat facetiously I suggest that what we are talking about here is more splash for the cash.

Then, you gentlemen of the Congress would have professional staffs unfettered by departmental restrictions reviewing the report, specific action proposals to consider, a more unified budget—and here I assume the new agency's proposals would be referred to the Appropriations Independent Offices Subcommittees rather than scattered in pieces among many subcommittees—and, after enactment, a chance to review achievements against goals with the responsible Government agency.

Before considering specific composition of the recommended agency, I would like to say a word about the companion National Advisory Committee for the Oceans (NACO). It will do the country little good to establish this advisory body without the agency to advise. Some may recommend this course to you as a last resort, but I urge you to heed to the advice of Commission member John Perry who advised on April 30 before you that, without NOAA, there was no point to NACO, and that the two ought to be considered as one proposal.

On committee composition, I hold with the Commission that there should be no Federal Government members. Also, the committee should not be exclusively industrial but should contain a mix of industry representatives, State representation and people from the academic community. I would also follow the recommendation of the Commission's Panel on Marine Engineering and Technology that industrial representation should include at least eight major areas: transportation, petroleum, fishing, mining, desalination, recreation, hardware, and services.

The first organization suggested for inclusion in the National Oceanic and Atmospheric Agency is the Coast Guard. It has been described as the "guts" of the agency. I endorse this recommendation, although I recognize questions have been raised about it. To deal with several, on the question of the Coast Guard's defense role, I feel it can continue as well or better in NOAA than in the Department of Transportation, whose main focus is on such matters as railroads, airports, urban mass transit, and highways.

It has been objected that putting the Coast Guard into NOAA will mix operational matters with programing. While I respect this concern, I think careful organization internally can keep the two functions separate and prevent operational matters from dominating. The ocean environment is unique and must be served by research as well as operations to do an effective job. Furthermore, the very uniqueness of the oceans serves to unite the functions conducted there and to diminish the differences between operations and research.

The Coast Guard belongs in an ocean agency.

As for the objections filed March 10, 1969, by the Department of Transportation—which I read with dismay since they seemed to miss the message of the Commission report—I am struck by this fact: some of the arguments used against relocating the Coast Guard could be used to suggest the Department of Transportation never should have been formed. I refer to mentions of possible loss of effectiveness from regrouping, "administrative upheavals" and the ability to coordinate without reorganization.

I think the activities of the Bureau of Commercial Fisheries would be enhanced by transfer to an ocean agency, as will certain functions of the Sport Fisheries and Wildlife Bureau.

The Department of the Interior has great responsibilities to protect and preserve our natural land resources, manage our national parks, oversee mineral resources, conduct Indian affairs, conduct geological surveys and promote desalination, and the complex problems of our diverse fisheries industry will be better served in an organization with a sharper focus on the oceans.

I subscribe to the inclusion of the Enviornmental Science Services Administration basically because of the necessary involvement of the

Weather Bureau in ocean science, since understanding weather systems requires it, and because of the obvious relationship of the Coast and Geodetic Survey to the activities of NOAA.

It has been argued that removal of ESSA will dimish the Department of Commerce, perhaps even end its life, and thereby, hurt the business community which it represents.

First, in response to this concern, I do not believe ESSA's activities in any way relate to representation of business, and second, I think the business community is not impressed by the size of the Department of Commerce's payroll or its budget but rather by the quality of the services performed and the caliber of its leadership.

The National Sea Grant program, U.S. Lake Survey, and National Oceanographic Data Center belong in NOAA.

In the case of each of these organizations, the following can be said: Their services will be improved by presence in NOAA, NOAA will benefit from their participation—and the national interest will be served.

Of course, affected departments are going to file objections to the formation of NOAA because they will lose personnel, budget and, they think, stature. In this connection, the comment on a National Oceanography Association questionnaire from an employee in one of the agencies suggested for transfer sums it up:

> Reorganization is needed and wanted by people at the working bureau level, but opposed by the existing departments. This has been historically true and clearly illustrates why reorganization is needed. The existing departments are just not marine oriented * * *

We then come to another suggestion about NOAA—that no action should be taken until decisions are made on other possible major reorganization within the Government. A Department of Science has been suggested, a Department of Natural Resources, a Department of Environmental Affairs, and so on. Whether any of these or other alterations come about, we still will need the grouping of ocean and atmospheric activities that is NOAA. Furthermore, the new agency could fit into almost any of the suggested departments as a unit and is, in fact, a logical first step toward more fundamental restructuring. Taking this step now could well enhance such future action.

An additional point is—no matter what other reorganizations come, we need NOAA now to set our ocean affairs in order and no additional amount of study of reorganization could possibly improve on the work of the Stratton Commission.

To me, one of the most convincing comments about NOAA came from Dr. Stratton at his appearance on April 30 before you.

He told you that personally he was "appalled" at the idea of another Federal independent agency when he first heard the suggestion. We can understand this reaction, given the proliferation of Federal agencies and programs and the sometimes chaotic condition of governmental structuring in this country today. Now, as you know, Dr. Stratton is a vigorous advocate of NOAA. From his background in science and major organizations, he is convinced of the logic of taking this action now.

It is in spite of our reluctance to add to the number of independent agencies in Washington and not because we think a Federal agency

and Federal dollars are cure-alls that we come to you to urge creation of NOAA and its companion advisory group, NACO.

There is another suggestion I would like to deal with, that oceanography somehow isn't relevant to conditions today—in the world, in the cities or with major problems.

I say oceanography is as relevant as a hurricane hitting the coast without adequate warning, as relevant as the need for protein in many diets abroad and in this country, as relevant as polluted Lake Erie to a youngster in Cleveland on a hot August day and as relevant as the U.S. Navy is to the defense of this country.

In addition, the social benefits that can be achieved through the application of ocean science and technology to the problems of our cities and to the development of the human resources in our coastal plains has already been noted within the Government. During the past year, the Economic Development Administration of the Department of Commerce has given considerable attention to the development of the marine environment and its resources as a means for achieving economic growth in the coastal plains of the Carolinas and Georgia.

The Office of Sea Grant Programs of the National Science Foundation, although it concerns itself solely with higher education, is a first step in the Government's support of education to achieve regional development through oceanic and estuarine programs. Waterfront renewal and the provision of access for the urban underprivileged to the marine environment for purposes of recreation are a goal of the open space and urban renewal programs of the Department of Housing and Urban Development. Some imaginative industry programs have begun in these areas. Once more, this social mission for the application of what we have learned in the last decade for the good of the citizen is fragmented. To achieve maximum social responsiveness of the new technology, a unified approach such as NOAA is required.

I hope this subcommittee will report to the full committee soon, a bill forming NOAA, and on the same bipartisan basis that has guided you before. And that the Nixon administration will either endorse that bill or move on its own to accomplish the same objective through the Reorganization Act.

The President is one who has spoken about the need to act. I quote from his speech in Miami on October 30 last year, entitled, "The Sea—Our Last Unexplored Frontier," when he referred to the "fragmented and confused" national oceanographic effort and the need to consider a sea agency. We continue to be optimistic that support from the administration will be forthcoming. Together with the support manifest here and elsewhere in Congress, I am encouraged that we can soon begin to move into what some have already called the ocean decade.

In closing, I would like to submit for the record results of two National Oceanography Association questionnaires. The first was taken in mid-February at the time copies of the Commission report were being distributed. Eighty-one percent of those responding supported the independent agency concept and general support for other Commission findings was voiced. The second questionnaire sent out last month seeks opinion on the precise composition of NOAA and alternatives to it. The returns on this second survey are not complete, but the preliminary results through May 12 are shown and they also reveal strong support for NOAA among industry, the academic community, and the general public.

Those answering the second questionnaire were asked if their names could be used as participants, and I would like to list those answering in the affirmative so you can see the diversity of interests represented.

Thank you.

Mr. HATHAWAY (presiding). Thank you very much, Mr. Clotworthy. I appreciate your very thoughtful and detailed statement.

There is only one general question that I have. In any reorganization when you are thinking perhaps of putting some agency into a new agency, you are going to run into trouble. One problem that bothers me is the Weather Bureau. Since the Weather Bureau is concerned with problems of the ocean and of the land as well, do you think that ESSA will still function as well in a new agency?

Mr. CLOTWORTHY. Yes, I do. I realize the problems we have in any question of reorganization. A line has to be drawn somewhere, and the decision as to where the line is to be drawn is most difficult. I believe there is a clear and logical reason for keeping the Weather Bureau with ESSA and making it a part of the ocean agency. Simply because weather on this planet is made up so completely of those physical and chemical reactions that take place over the land as well as over the ocean, I don't think you can separate them very well, and since the planet is predominantly a water planet, it certainly follows that oceans contribute in a very major share to the formation of weather systems.

It is quite apparent further that the same kinds of monitoring systems which we presently have over land which we use as a tool to help in the prediction of weather will ultimately be needed throughout the world oceans in order to complete our synoptic picture of world weather.

So, therefore, I don't think that there is any reason to believe that the Weather Bureau's inclusion within the NOAA will in any way detract from the performance of the service for which it was established. In fact, if anything, it will be enhanced.

Mr. HATHAWAY. You don't think it will become so marine oriented that it will fail to serve its other function of performing weather service for land-based activities?

Mr. CLOTWORTHY. No, I don't. I believe weather is 70 percent marine oriented anyhow simply because of the distribution of the oceans on the planet.

Mr. HATHAWAY. Mr. Karth.

Mr. KARTH. I have no questions.

Mr. HATHAWAY. Mr. Mosher.

Mr. MOSHER. Mr. Chairman, I would like to comment on page 4 of this very vigorous statement by Mr. Clotworthy, at that point where he refers to what he anticipates will be the understandable reluctance of the Congress to renew the Marine Resources Council after June 30, 1970. I think it is a very important point that he makes there.

You will remember that I originally introduced legislation which would renew the Council for an indefinite period until such point as the Congress replaced it with some other form of reorganization.

In the discussion here in the committee, and then later the House concurred completely and the Senate also, it was decided to put a date certain to the conclusion of the Council on June 30, 1970. I think we acted wisely in doing that because we thus set a deadline for ourselves and we thus emphasized, I think, how imperative it is that we do act in this session of the Congress on some such concept as NOAA.

Therefore, I personally want to accent the point that Mr. Clotworthy made there. I like the sense of urgency in his statement. I think it is imperative that we move for reorganization.

I notice in the beginning of his statement that he does raise two very important question marks concerning the Stratton Commission report. Particularly he raises some doubts about the international law recommendations. I don't think we should allow any such question marks as to detail, I don't think we should allow any such doubts, to take us off on tangents and divert our attention from the big job which is the urgency of this reorganization matter, and I hope, Mr. Clotworthy, that I have rightly interpreted your statement in that respect.

Mr. CLOTWORTHY. You have, sir.

Mr. HATHAWAY. Mr. Pelly.

Mr. PELLY. I would like to indicate my admiration for your forthrightness and the fact that you are very specific in your recommendations. I think that is what we need in this committee, to have representatives of industry and individuals speak right out.

I particularly appreciated your calling attention to the fact that the Navy has never had proper recognition for the way it carried on when other agencies of the Government were unable or unwilling or at least failed to recognize the needs of oceanography. I think the Navy has done a magnificent job and we should all be grateful to it.

I want to ask you to be a little more specific, however, on this matter of international law. You say on page 4, quoting, that "* * * the United States should continue implementation of the principles of the convention. * * *"

What are the principles of the International Convention on the law of the sea that you refer to there?

Mr. CLOTWORTHY. Well, the interpretation of the outer bounds of the shelf, of course, has been a subject of much discussion since the convention. I am referring here to the 200-meter isobath.

Mr. PELLY. Do you think this provision is vague the way it is written into the international convention of 1958?

Mr. CLOTWORTHY. Yes, I think it is vague, but perhaps purposely vague. I think that as a Nation we have chosen a more liberal interpretation of it and go out beyond the 200-meter isobath, and that is what I was quoting from.

Mr. PELLY. I think the members of this committee have indicated their concern that through some international arrangement we might yield the sovereignty which was given us in that convention. We do have sovereignty over the Continental Shelf and beyond where we can exploit it. I am not quite sure from your statement where the National Oceanography Association stands so far as, for example, the action which has been taken in the United Nations is concerned.

Mr. CLOTWORTHY. If I may comment on the domestic situation first, I believe leases to Continental Shelf territory have been granted beyond the 200-meter isobath so in effect I am saying we endorse the practice of Government thus far to go beyond the 200-meter isobath where it appears to be in our best interests and within our technical capability to do so.

Mr. PELLY. Do you think that is vague?

Mr. CLOTWORTHY. No, I don't think it is vague. I think the action has been very forthright.

Mr. PELLY. And you support it?

Mr. CLOTWORTHY. I support it. With respect to the United Nations and the activities there, we certainly commend the study that is taking place now, the dialog among nations as to what must be accomplished in future times. We do not want to see, as some have suggested, the seabeds becoming a hotbed of international political activity in the future to the point where there are military consequences.

We want to se the peaceful development of oceanic resources in the deep seabed, but we feel that this should be done through normal treaty mechanisms rather than the outright usurping of sovereignty through a body such as the United Nations or through such a mechanism as the Malta proposal. We believe that we have in the past as a Nation been able to negotiate international treaties with other Nations where we have common interests and common problems and that this is a satisfactory mechanism for handling the exploration and exploitation of the deep sea resources in the future.

Mr. PELLY. In other words, by international convention and agreement among nations as to the problems that confront us in connection with the seabed and the oceans in the future?

Mr. CLOTWORTHY. Yes, as opposed to the assumption of sovereignty by the United Nations.

Mr. PELLY. For example, unilateral action in claiming a fishing zone, or territorial sea for 200 miles, we will say, contrary to any international convention in this area, you would oppose.

Mr. CLOTWORTHY. The 200-mile presumption, which I would prefer to call it, is a unilateral action. I am talking about multilateral actions as the proper course of events.

Mr. PELLY. I think you have been very explicit, and I certainly commend you for your clarification and your support of this proposed legislation. I think we can probably clear up some of the international vagueness and lack of agreement if we have such an independent agency much better than we can if the responsibility is divided among all the different departments of Government.

I think implementation of this program will certainly be very helpful. I want to thank you for your very fine statement.

Mr. HATHAWAY. Congressman Keith?

Mr. KEITH. No questions.

Mr. HATHAWAY. Congressman Schadeberg?

Mr. SCHADEBERG. To follow the comment, I agree with the past statement, but could you suggest as to what the difficulty would be if it were accomplished through such a proposal as the Malta proposal in the United Nations? What would be involved that would affect our research and so forth?

Mr. CLOTWORTHY. Well, as I interpret the intent of the Malta proposal, it was to delegate sole responsibility, executive responsibility for the development of deep sea oceanic resources beyond the Continental Shelf to an international body. I don't subscribe to this because I don't think that an international body, where one nation such as ours can be counted only to the extent of one vote in a body made up of many nations, and considering our abilities to explose and exploit the oceanic resources, if proper.

I think that we have a larger stake and that work among maritime nations who have the principal interest and the principal technical capability for exploration and exploitation will be in the long run better for world population than if we go the delegation route, the delegation to the United Nations.

I think that the natural forces in the economy will make it advisable for the principal industrial nations of the world, the maritime industrial nations of the world, to explore and exploit for deep sea resources as the need is generated and as there is an economic rationale for so doing that, and that there is no need in effect to delegate this to an international body which I believe is relatively insensitive to some of these market factors and certainly is a very difficult body in which to achieve any unanimity, any general agreement on courses of action.

I don't think that we have seen in the past the kind of leadership coming from the United Nations as supposedly a cohesive world body that gives me any confidence that as a world we will be able to move ahead in exploration and exploitation of the deep sea resources.

I think this has to be left to the principal industrial nations. It will be done more efficiently, more effectively, and the population of the world will generally benefit to a far greater degree if we leave it to this kind of a natural mechanism and the bilateral treaties, multilateral treaties, I believe, are the mechanism for providing the legal framework in which this exploration and exploitation can go forward.

Mr. SCHADEBERG. I am in complete agreement with you on that statement. I am glad to have it for the record because many times we are asked that and want to know what some thinking on it may be. Thank you very much.

Mr. HATHAWAY. Mr. Karth.

Mr. KARTH. Thank you, Mr. Chairman.

I am sorry, Mr. Clotworthy, that I was not able to hear your full statement. As unfortunate as it may appear to be, constituents always come first. I do want to commend you, though. I think this is the most forceful and specific statement that we have received before the subcommittee by anyone other than perhaps those who were members of the Commission.

As I went through some of the statements which I was not privileged to hear I could not help but see this $773 million figure. It is the first time I have seen it related specifically to ocean research.

I wondered if you could be more specific and perhaps for the record break down where the $773 million was spent this year in civilian oceanography activities.

Mr. CLOTWORTHY. I will try, if we can find the section of the Commission report very quickly here.

Mr. KARTH. I thought they were talking about $500 million or thereabouts. It seems to me that this $773 million is new to me specifically relating to civilian ocean sciences.

Mr. CLOTWORTHY. The $500 million may be the Council's figure. This is a terribly difficult problem, the accounting problem, because it all depends on what you wish to include in that general grouping of moneys that support civilian oceanography.

Mr. KARTH. I think it would be helpful to the committee if someone could do this bit of accounting. If it comes up to the three-quarter billion dollar mark, it might make it easier for the committee in the

future to talk in terms of a billion dollar budget because that is not a great deal more than what we are spending this year.

Mr. CLOTWORTHY. May I cover this in two parts? On page 258 of "Our Nation and the Sea," the report of the Commission, the second paragraph says:

> The 1969 budgets for the agencies and programs which would be immediately transferred to NOAA under the Commission's organization plan total $773 million.

I believe there is a breakdown in the text of what portion of each of the existing agencies' budgets would be transferred into NOAA and how that figure would be derived.

Mr. MOSHER. Would the gentleman yield?

Mr. KARTH. Yes.

Mr. MOSHER. That would include some of the land activities presently operating, wouldn't it; the Weather Bureau and so forth? This figure would include that?

Mr. CLOTWORTHY. That would include the Weather Bureau; yes. They go on to say, "Other activities which might be transferred to the agency at a later date would add an additional $36 million."

I think it is important to distinguish that in the Commission's recommendation for the expenditure of some $8 billion over a 10-year period, they are talking about $8 billion in addition to the funds that are presently being spent by these agencies.

Mr. MOSHER. I think that is very important.

Mr. CLOTWORTHY. So that the annual budget then goes to well over a billion dollars.

Mr. KARTH. Thank you very much.

In your statement you refer specifically to civilian oceanography activities, and I am not sure that this figure includes just civilian oceanography activities but includes things that might be performed by these agencies that they are suggesting be transferred, other than that.

Mr. CLOTWORTHY. Yes; that is true.

Mr. MOSHER. Will the gentleman yield again?

It is obviously not only an accounting problem, but a problem of definitions.

Mr. KARTH. I am willing to accept your definition if you can substantiate it a little better. Thank you very much.

Mr. CLOTWORTHY. Perhaps I can find the breakdown reference in the Commission report and pass that to counsel after the hearing if that is OK.

Mr. KARTH. Thank you very much.

Thank you, Mr. Chairman.

Mr. HATHAWAY. Mr. Clotworthy, we thank you again for your excellent statement which will be extremely helpful to us when we consider this in executive session.

I want to say that Congressman Rogers asked me to apologize to you for the fact that he had to leave early. He had a prior commitment which he couldn't avoid.

Thank you very much.

Mr. CLOTWORTHY. Thank you, Mr. Chairman.

(Attachments referred to follow:)

LIST OF PERSONS RESPONDING TO NATIONAL OCEANOGRAPHY ASSOCIATION QUESTIONNAIRE 1969/2 PERMITTING IDENTIFICATION

Mr. Robert C. Arnim, R. C. Arnim Oil and Gas Operations, Limited, Calgary, Alberta, Canada.
Mr. Robert C. Avondo, Auburn and Associates, Incorporated, Pittsburgh, Pennsylvania.
Mr. Tom Baker, Diamond Springs, California.
Dr. Leonard F. Barrington, Air Products and Chemicals, Incorporated, Marcus Hook, Pennsylvania.
Mr. Roy N. Barthom, Beebe Brothers, Incorporated, Seattle, Washington.
Mr. H. A. Bedell, Bel-Ray Company, Incorporated, Farmingdale, New Jersey.
Mr. Albert G. Berberian, D. G. O'Brien, Incorporated, Framingham, Massachusetts.
Mr. David T. Bernstein, Kingston, Rhode Island.
Mr. Kris P. Blackmarr, Boulder, Colorado.
Miss Marguerite E. Bryan, AFL–CIO Maritime Committee, Washington, D.C.
Mr. E. R. Bullock, B&R Tug and Barge, Incorporated, Kotzebue, Alaska.
Rear Admiral Thomas Burrows, (Retired), Washington, D.C.
Mr. Richard F. Burt, Laconia, New Hampshire.
Mr. Kenneth P. Camisa, International Organization of Masters, Mates and Pilots, New York, New York.
Mr. James N. Casto, Charleston, West Virginia.
Mr. Arnold Clickstein, Charles River Academy, Cambridge, Massachusetts.
Dr. Salvatore Comitini, University of Hawaii, Honolulu, Hawaii.
Mr. Will Connelly, Marine Acoustical Services, Incorporated, Miami, Florida.
Mr. Louis G. Dameson, Jr., Cubic Corporation, San Diego, California.
Mr. Robert G. Day, Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island.
Mr. Samuel L. Dederian, Galileo High School, San Francisco, California.
Mr. Cyle Dickson, Madison, Wisconsin.
Mr. W. C. Difford, Wisconsin State University, Stevens Point, Wisconsin.
Mr. Raymond Dispoto, Scarsdale High School, Scarsdale, New York.
Mr. Carey D. Domme, Topeka, Kansas.
Mr. Karl A. Drescher, San Antonio, Texas.
Mr. Paul Ducklow, Sheboygan, Wisconsin.
Mr. Mello G. Fish, AFL–CIO Maritime Committee, Washington, D.C.
Mr. M. B. Frank, West Los Angeles, California.
Mr. Karl Franz, Westerly, Rhode Island.
Mr. William T. Gardner, Seneca Valley High School, Harmony, Pennsylvania
Mr. J. A. Gast, Humboldt State College, Arcata, California.
Mr. W. S. Gleeson, FRAM Corporation, Providence, Rhode Island.
Mr. William L. Griffin, Washington, D.C.
Mr. Hoyt S. Haddock, AFL–CIO Maritime Committee, Washington, D.C.
Mr. John W. Harrington, Specialty Ships, Unlimited, Incorporated, Washington, D.C.
Mr. John R. Hendrickson, University of Arizona, Tucson, Arizona.
HMZ Anthony Hill, U.S.N., F.P.O. San Francisco, California.
Mr. Robert D. Howard, California Divers, Incorporated, Santa Barbara, California
Mr. Timothy C. Irish, Lehigh, Iowa.
Mr. Lionel S. Johns, Ocean Science and Engineering, Incorporated, Washington, D.C.
Miss Virginia Johnson, Cape May Court House, New Jersey.
Mr. Ronald S. Kandzer, Novelty, Ohio.
Mr. Mitchell A. Kapland, Trident Engineering Associates, Incorporated, Annapolis, Maryland 21401.
Mr. George W. Kelley, Youngstown State University, Youngstown, Ohio.
Mr. H. B. Kennerly, Jr., H. B. Kennerly and Son, Nanticoke, Maryland.
Dr. John A. Knauss, University of Rhode Island, Kingston, Rhode Island.
Mr. John A. Lamb, F.P.O. New York, New York.

Mr. Edward J. Langey, American Metal Climax, Incorporated, New York, New York.
Mr. Paul G. Langfeld, Langfeld Manex Corporation, New York, New York.
Mr. Phillip Lazzara, Blue M Electric Company, Blue Island, Illinois.
Mr. R. Lethi, Bunnell High School, Stratford, Connecticut.
Mr. Mike Libby, Midland, Texas.
Mr. E. Alan Lohse, Gulf Universities Research Corporation, Houston, Texas.
Mr. Bruce W. Lowny, Indianapolis, Indiana.
Mr. James S. Lunn, Lunn Laminates, Incorporated, Wyandauch, New York.
Mr. Ben S. Man, AFL–CIO Maritime Committee, Washington, D.C.
Mr. Wilbur Marks, Poseidon Scientific Corporation, Hauppange, New York.
Mr. Jack T. Marshall, J.T.M. Professional Diving Service, Trumansburg, New York.
Mr. R. F. McAllister, Florida Atlantic University, Boca Raton, Florida.
Mr. Philip A. Miller, Tooele, Utah.
Mr. Robert T. Monroe, Columbus, Ohio.
Mr. Clarkson P. Moseley, Signal Oil and Gas Company, Houston, Texas.
Mr. James R. Moss, Marine Colloids, Incorporated, Springfield, New Jersey.
Mr. Thomas F. Norton, The Skipper Publishing Company, Annapolis, Maryland.
Mr. Robert J. O'Connell, Simplex Wire and Cable Company, Portsmouth, New Hampshire.
Mr. Daniel A. Panshin, Oregon State University, Corvallis, Oregon.
Mr. Roger J. Pierce, Hydro Space Systems Corporation, Cedar Rapids, Iowa.
Mr. W. A. Plummer, The Zippertubing Company, Los Angeles, California.
Mr. Charles H. Powers, Bendix Field Engineering, Montrose, California.
Miss Joyce Raia, Staten Island, New York.
Dr. Robert J. Reinold, University of Georgia, Marine Institute, Sapelo Island, Georgia.
Mr. Roy J. Ricci, Procedyne Corporation, New Brunswick, New Jersey.
Dr. James A. Roberts, James A. Roberts Associates, Incorporated, Newport Beach, California.
Mr. E. A. Rodgers, Maine Maritime Academy, Castine, Maine.
Mr. Kenneth A. Roe, Burns and Roe, Incorporated, Oradell, New Jersey.
Mr. Ferdinand S. Ruth, Berkeley, California.
Mr. W. Frederick Sampson, Palos Verdes, California.
Mr. John E. Sanders, Barnard College, New York, New York.
Mr. David I. Schactman, Lynn, Massachusetts.
Miss Jean L. Schwartz, Marion, Massachusetts.
Mr. W. E. Seachrist, Kent Industries, Incorporated, Kent, Ohio.
Mr. Douglas B. Seba, Miami Beach, Florida.
Mr. Paul Shew, Oceanside, California.
Mr. Robert L. Smith, Salem Oil and Grease Company, Salem, Massachusetts.
Mr. Willard Smith, III, Willard's Orange-Ice Company, Orange, California.
Mr. William R. Sorensen, The Emerson Consultants, Incorporated, New York, New York.
Mr. Richard T. Steel, Flushing, New York.
Mr. F. R. Storke, MacLeod Instrument Corporation, Fort Lauderdale, Florida.
Mr. Stuart M. Strait, Alma College, Alma, Michigan.
Mr. Timothy J. Sullivan, Oakview Junior High School, Skokie, Illinois.
Mr. Milton D. Taylor, Blacksburg, Virginia.
Dr. Donald A. Thomson, University of Arizona, Tucson, Arizona.
Mr. Edward J. Valentine, Waterford, Connecticut.
Dr. Jack R. VanLopik, Louisiana State University, Baton Rouge, Louisiana.
Mr. Stanley J. Volens, AFL–CIO Maritime Committee, Washington, D.C.
Mr. Michael J. Walsh, Coronado, California.
T/Sgt. Martin O. Wascher, USAF, Midwest City, Oklahoma.
Dr. Charles G. Wilber, Colorado State University, Fort Collins, Colorado.
Mr. Warren B. Wimer, Beckman Instruments, Incorporated, Fullerton, California.
Mr. Donald E. Wohlschlag, University of Texas, Marine Science Institute, Port Aransas, Texas.
Mr. F. F. Wright, University of Alaska, Institute of Marine Science, College, Alaska.
Mr. Robert T. Wright, Stenographic Machines, Incorporated, Skokie, Illinois.
Mr. M. R. Yeiter, EG & G International, Incorporated, Waltham, Massachusetts.
Miss Patricia L. Zilinkes, Dayton, Ohio.

NATIONAL OCEANOGRAPHY ASSOCIATION QUESTIONNAIRE RESULTS, 1969/1 [1]

Questions	115 Corporate			148 Individual			263 Total		
	Yes	No	No opinion	Yes	No	No opinion	Yes	No	No opinion
1. (a) A new strong Federal focus for marine activity is essential to a national ocean effort	111	1	3	140	7	1	251	8	4
Percent	96.6	.8	2.6	94.6	4.7	.6	95.5	3.0	1.5
(b) The Commission recommends that the National Oceanic and Atmospheric Agency (NOAA) be established as an independent agency, reporting directly to the President	95	13	7	119	22	7	214	35	14
Percent	82.6	11.3	6.1	80.4	14.9	4.7	81.4	13.3	5.3
(c) The Commission recommends that the National Oceanic and Atmospheric Agency initially be composed of the U.S. Coast Guard, the Environmental Science Services Administration, the Bureau of Commercial Fisheries (augmented by the marine and anadromous fisheries functions of the Bureau of Sport Fisheries and Wildlife), the National Sea Grant program, the U.S. Lake Survey, and the National Oceanographic Data Center	87	12	16	110	20	18	197	32	34
Percent	75.6	10.5	13.9	74.3	13.5	12.2	74.9	12.2	12.9
2. Programs recommended by the Commission are estimated to involve an annual expenditure growing to 1980 to roughly $1,000,000,000 per year over and above current program levels	85	12	18	114	7	27	199	19	45
Percent	73.9	10.4	15.7	77.0	4.7	18.3	75.7	7.2	17.1
3. The Commission proposes that a small group of institutions, including the present leaders in ocean research, be designated by the Federal Government as university-national laboratories and equipped to undertake major marine science tasks of a global or regional nature. (Estimated Federal cost, 1971 to 1980, $445,000,000.)	82	22	11	112	24	12	194	46	23
Percent	71.3	19.1	9.6	75.7	16.2	8.1	73.8	17.5	8.7
4. The Commission recommends that the primary responsibility for management of the coastal zone continue to be vested in the States but that Federal legislation be enacted to encourage and support the creation of State coastal zone authorities to carry out specified national objectives with regard to the zone. The authorities should have clear powers to plan and regulate land and water uses and to acquire and develop land in the coastal zone	89	16	10	100	30	18	189	46	28
Percent	77.4	13.9	8.7	67.6	20.2	12.2	71.9	17.5	10.6
5. The Commission recommends that NOAA launch a national project to explore the techniques of water quality restoration for the Great Lakes. (Estimated Federal cost, 1971 to 1980, $175,000,000.)	92	5	18	117	13	18	209	18	36
Percent	80.0	4.3	15.7	79.1	8.7	12.2	79.5	6.8	13.7
6. The Commission recommends that legislation be enacted to remove the present legal restrictions on the use of foreign-built vessels by U.S. fishermen in the U.S. domestic fisheries	74	18	23	105	21	22	179	39	45
Percent	64.3	15.7	20.0	71.9	14.1	14.8	68.1	14.8	17.1
7. There is no urgent necessity to develop subsea hard minerals with maximum speed regardless of cost. Nevertheless, an early start of offshore exploration and development of the required technology is warranted to determine reserves and to establish a basis for future exploration. (Estimated Federal cost, 1971 to 1980, $150,000,000.)	94	13	8	124	17	7	218	30	15
Percent	81.8	11.3	6.9	83.8	11.5	4.7	82.9	11.4	5.7
8. The Commission recommends that the United States take the initiative to secure international agreement on a redefinition of the "continental shelf" for purposes of the Convention on the Continental Shelf. The seaward limit of each coastal nation's "continental shelf" should be fixed at the 200-meter isobath, or 50 nautical miles from the baseline for measuring the breadth of its territorial sea, whichever alternative gives it the greater area for purposes of the convention	76	25	14	110	19	19	186	44	33
Percent	66.1	21.7	12.2	74.4	12.8	12.8	70.8	16.7	12.5

See footnote at end of table, p. 314.

NATIONAL OCEANOGRAPHY ASSOCIATION QUESTIONNAIRE RESULTS, 1969/1 [1]—Continued

Questions	115 Corporate			148 Individual			263 Total		
	Yes	No	No opinion	Yes	No	No opinion	Yes	No	No opinion
9. The Commission recommends that NOAA support technology development of power systems necessary for undersea operations and resource development, and that an experimental continental shelf submerged nuclear plant be constructed to pilot test and demonstrate the feasibility and cost of the use of nuclear power for resource development operations and of the underwater siting of nuclear facilities to provide power for coastal regions. (Estimated Federal cost, 1971 to 1980, $230,000,000.)	75	25	15	106	25	17	181	50	32
Percent	65.3	21.7	13.0	71.6	16.9	11.5	68.8	19.0	12.1
10. The Commission recommends that NOAA launch a continental shelf laboratories national project to provide a national capacity for research, development, and operations on the continental shelf. (Estimated Federal cost, 1971 to 1980, $500,000,000.)	86	13	16	125	16	7	211	29	23
Percent	74.8	11.3	13.9	84.5	10.8	4.7	80.3	11.0	8.7
11. The Commission recommends that NOAA sponsor an explicit program to advance deep ocean fundamental technology and proceed with a national project to develop and construct exploration submersibles with deep ocean transit capability with civil missions to 20,000-foot depths. (Estimated Federal cost, 1971 to 1980, $285,000,000.)	81	25	9	118	21	9	199	46	18
Percent	70.5	21.7	7.8	79.7	14.2	6.1	75.7	17.5	6.8
12. The Commission recommends that NOAA launch a national project to develop a pilot buoy network. (Estimated Federal cost, 1971 to 1980, $85,000,000.)	76	13	26	83	22	43	159	35	69
Percent	66.1	11.3	22.6	56.1	14.9	29.0	60.5	13.3	26.2

[1] Total received: 263, 15 percent; total mailed: 1,700.

National Oceanography Association Questionnaire Preliminary Results—1969/2*

1. The Commission on Marine Science, Engineering and Resources recommended that the following agencies be included in a new independent National Oceanic and Atmospheric Agency. Please indicate your views on the inclusion of each of these agencies:

	Total					
	Yes	Percent	No	Percent	No opinion	Percent
A. Coast Guard	186	61.4	86	28.4	31	10.2
B. Bureau of Commercial Fisheries	276	91.1	17	5.6	10	3.3
C. Environmental Science Services Administration	270	89.1	16	5.3	17	5.6
D. Certain marine and anadromous functions, Bureau of Sport Fisheries and Wildlife	229	75.6	38	12.5	36	11.9
E. National sea grant program	270	89.1	15	5.0	18	5.9
F. U.S. lake survey	227	74.9	39	12.9	37	12.2
G. National Oceanographic Data Center	292	96.4	10	3.3	1	.3

2. Other possible components of a National Oceanic and Atmospheric Agency have been suggested by sources outside the Commission. Please indicate your views as to whether or not the following should be included:

*Received through May 12, 303—Mailed 3,000. Corporate—177, Individual—126.

	Total					
	Yes	Percent	No	Percent	No opinion	percent
A. Civil works functions of U.S. Army Corps of Engineers relating to the coasts	149	49.2	105	34.6	49	16.2
B. Federal Water Pollution Control Administration (now in the Department of the Interior)	199	65.7	79	26.1	25	8.3
C. Maritime Administration (now in the Department of Commerce)	128	42.2	119	39.3	56	18.5
D. National Oceanographic Instrumentation Center	268	88.4	19	6.3	16	5.3
E. Office of Saline Water (now in the Department of the Interior)	192	63.4	56	18.5	55	18.1

3. Alternatives to establishing an independent National Oceanic and Atmospheric Agency that would provide a Federal focus on ocean activities generally include the following. Check the one alternative you think most suitable. If you favor the independent agency approach, check item F.

[Choose One]

		Percent
A. Coordination of Federal marine activities through a staff-level body similar to the former Interagency Committee on Oceanography	6	2.1
B. Continue present cabinet-level National Council on Marine Resources and Engineering Development	3	1.0
C. Continue present Council with the addition of some operating capacity and funds for that purpose	2	.7
D. Establish an interagency task force on marine matters to settle lead-agency responsibility for major projects	10	3.4
E. Group marine-related functions within an existing department, such as the Department of Commerce	3	1.0
Department of the Interior	10	3.4
Department of Transportation	1	.3
F. An independent, operating agency	170	58.5
G. Consolidate ocean activities in a new cabinet-level department similar in composition to the proposed agency but with higher status	86	29.6
No response	12	

Mr. HATHAWAY. Our next witness is Congressman Bob Wilson of California.

We are always happy to have a Member of Congress testify before the committee. I understand, Bob, that you have a written statement which you can either read or summarize.

STATEMENT OF HON. BOB WILSON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. WILSON. Thank you, Mr. Chairman, and members of the committee. I would like to submit a statement for the record and make a few brief comments.

Mr. HATHAWAY. Without objection, the statement will be printed in the record at this point.

(The statement follows:)

STATEMENT OF HON. BOB WILSON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. Chairman and members of the Oceanography Subcommittee, I am pleased to have this opportunity to appear before you today and discuss the report of the Commission on Marine Science, Engineering, and Resources, "Our Nation and the Sea."

Many have come before you during your hearings on this report, endorsing the Commission's recommendation for establishing a National Oceanic and Atmospheric Agency to coordinate and direct our national marine policy in the years ahead. I wish to add my wholehearted endorsement to that proposal also.

Although I was the first to introduce legislation five years ago calling for the establishment of a single federal oceanographic agency, commonly referred to as a "wet-NASA," I am still of the opinion that the only way we can get a NOAA into being is for the President himself to push for it through a reorganization plan. When I introduced my bill to set up NOA in 1964, I asked the various departments involved for reports on the proposal. I got 15 of the saddest letters you ever saw in your life. All were negative: each agency or department argued that its oceanographic effort was the most important function of its own agency. They couldn't possibly give up that responsibility to some independent agency, they reported. Simply put, they would rather fight than switch. Their opposition to such a proposal would hamper any legislative effort to create a single oceanographic effort. We are never going to win approval of this kind of legislation until the President champions the cause by seeking Congressional approval of a reorganization plan that would establish NOAA.

As a member of the Armed Services Committee, I watched what happened when the Administration at that time pushed the proposal for setting up the space agency, NASA. Oh, we heard the cries of anguish from the Air Force and the Navy because they had missile programs that were the most important things they were doing, and a NASA concept would completely emasculate and devastate those particular departments if it took any of their missile functions away from them. Yet only because we had the foresight through the reorganization procedure to set up a space agency were we able to accomplish a well-coordinated space effort.

The Commission's report, however, overlooks an important point. It does not deal with the question of what committees in Congress should oversee the new NOAA once it is established. I would recall that when NASA was created, a concurrent reorganization of the House committee structure took place with the creation of the Committee on Science and Astronautics. Likewise, I believe that any establishment of a Federal oceanographic agency must be accompanied with the designation of a House committee to oversee the new agency and its various efforts. This could be done by changing the name of the Merchant Marine and Fisheries Committee to the Oceanographic Committee and giving it the responsibility of authorizing the new agency's programs. Right now, our oceanographic effort—scattered among 22 agencies—is parceled out to numerous committees for review. When departments that deal in oceanography come to Congress to testify on thir budget requests, Congress, in effect, is looking at our oceanographic effort in bits and pieces with no attention given to the program as a whole or to how each piece relates to the other.

The Commission recommends that NOAA should be comprised of the U.S. Coast Guard, the Environmental Science Services Administration, the Bureau of Commercial Fisheries, the U.S. Lake Survey, the National Sea Grant Program, the National Oceanographic Data Center, certain programs of the Bureau of Sport Fisheries and possibly the National Center for Atmospheric Research. This reorganization would shift about 55,000 federal employees under the roof of NOAA as well as control of 320 seagoing vessels.

This shifting of agencies, of course, will trigger controversies among those departments that jealously protect their bureaucratic preserves. But all of us must put these petty jealousies aside and tackle the real issue here which is the nation's interest.

I am hopeful this Administration will propose the creation of NOAA. President Nixon spoke about the need for such an agency during the campaign. Vice President Agnew, who is from a coastal state involved in oceanography, is very enthusiastic about the possibility of NOAA, and has advised the President and his associates that a unified oceanographic program should have high priority in the Nixon Administration.

Mr. Chairman, I congratulate your Subcommittee for holding these hearings and again turning the national spotlight on the importance of investing in the oceans so that one day we can reap its many resources.

Mr. WILSON. Thank you.

This is my third appearance before this subcommittee on this subject, and I want to commend the subcommittee and the committee for

its diligence in bringing the whole oceanographic community this far along the track.

I introduced the first legislation, I think the chronology will show, 5 years ago, to set up an agency to be known as the National Oceanographic Agency. In doing so I realized that there was little likelihood the bill would become law because the complexity of taking the various oceanographic functions from other agencies and putting them into one agency is so great and prone to inciting strong resistance from the agencies involved.

Obviously I believe the steps this committee took in its wisdom of first setting up a council and a commission as a prelude to eventually, and I am positive it will come about, having a full-fledged agency was the right step to take.

There is no doubt that we have a parallel in what happened in NASA.

I recall sitting in and participating in hearings on the formation of NASA and, believe me, the agencies and departments involved screamed just as loudly over taking functions away from them as our agencies engaged in oceanography are now screaming about this proposal of the Commission.

The Navy swore up and down it couldn't survive without its missile effort. The Air Force of course said that everything it was doing was directly related to space and therefore it couldn't give up even its nonmilitary roles. It took the Presidential order, so to speak, to set up NASA, and it is going to take, in my opinion, a similar reorganization plan to set up NOAA.

I remember when I introduced my bill I asked the various agencies for reports on the bill. We got 15 reports, and they were the saddest reports you can imagine. The tears were running through every page of each of these agency reports. They just couldn't give up a most important function of their department to some other department.

Even though the word may come down from on high to these various departments to cooperate in the agency formation, I believe we are going to need the enthusiastic support of the administration through a reorganization plan to effect the recommendations of the Commission.

I heartily subscribe to the recommendations of the Commission. The agency that would be set up would be one of the biggest and most important agencies in Government with 55,000 employees and a navy of 320 vessels, and obviously a Department commanding the attention and the respect that oceanography deserves.

Also, previously, I think the counsel will remember and some of the committee members may remember that I suggested that even the name of your committee might be changed to the Comittee on Oceanography. I think it would clearly cover the responsibilities of the committee, and I think the committee would grow in responsibility and respect when it had jurisdiction over the legislation of the newly created agency.

Of course, you now have legislative jurisdiction over the Coast Guard and many of the other ocean-related activities, but to bring all of them into one agency that would champion the total cause of oceanography would be a more worthwhile endeavor for us in Congress and a more worthwhile endeavor for the administration.

So, all I can say is that I heartily subscribe to the recommendations of the Commission. I believe we might find after the agency is set up that there are other agencies that might be transferred to it in addition to the ones that have been recommended. The time is ripe for this country to realize the potential of the ocean.

We are conducting right at this moment tremendously important experiments in space and costly experiments in space that will expand our knowledge and bring great prestige to this country. But, believe me, the problems we face in feeding the people, the growing population of not only this country but the world, the problems we face in mining and the potential of exploiting the ocean bottoms, will make the space effort look almost offhand rather than as exciting as it appears today.

There is a tremendous potential that needs to be realized. I don't believe we are ever going to really get an effective and expanded program in oceanography going until this committee pushes hard for the recommendations of the Commission.

Thank you, Mr. Chairman, for the opportunity to testify.

Mr. HATHAWAY. Thank you. We appreciate your statement.

Do you think we can look forward to getting a statement of support from the administration in the near future with respect to establishment of this agency?

Mr. WILSON. I would hope so. I think it's incumbent on all of you as individual members and this committe as a body to convince the Vice President and the President of the importance of early action. I am not talking out of school, I am sure, in saying that at a leadership meeting at the White House a few weeks ago, the Vice President told the President and all of us that he felt the Commission's recommendations were sound and that this was the type of program the Nixon administration should get its full resources behind. No action was taken by the leadership at that time. This was merely a statement by the Vice President, and I am not trying to put words in his mouth. I think he is being properly cautious in making public statements as to what the plans are of this administration. But I have personally gone to the White House in a special appointment with the Vice President and urged him to use his full salesmanship and his full talents in trying to get this Commission report adopted and a reorganization plan underway. While he didn't commit himself positively to me, there is no question of his interest. I am confident you are going to see the Nixon administration come in with a recommendation to adopt the report of the Commission.

Mr. HATHAWAY. Very good. We are glad to hear that because, as you well know, coming from a coastal State, this committee has a very small constituency and we don't get much public pressure to install a new agency and the recommendation of the administration would carry considerable weight and help considerably to get this going.

Mr. WILSON. I don't know about your constituency, but I live on the sea coast. I remember one time we had some problems with beach erosion. So we called a meeting of all the Members who were concerned about beach erosion and it seemed to me that about half the House of Representatives showed up.

I didn't realize there were so many Congressman who represent areas adjacent to the oceans or the Great Lakes. I said one time only "the oceans" and Mr. Mosher chided me for not pointing out that he

is really on the ocean, too, in Ohio. But actually this committee has a tremendous constituency. The major cities are on the oceans, and we must get the Congress itself excited about this prospect. If I can talk a little partisan philosophy, this is truly an activity that Republicans ought to adopt because this is an activity that is clearly a Federal responsibility. We cannot go back to the States or go back to the local communities and have them do this. This is our responsibility as a Federal Government, and we are just not living up to it. I think as Republicans we are more to blame perhaps than anyone else that we are not doing so.

Mr. HATHAWAY. What I meant was that, although a lot of people should be interested in our affairs, so many of them are not. I think that if you sent out a questionnaire that had Merchant Marine and Fisheries activities on it, it would probably come in last in concern. Probably student unrest would be first. It is difficult at times to get people really alarmed about, say, the shortage of food that we may run into in the not too distant future, and for that reason we ought to have more of an effort placed on oceanography.

Mr. WILSON. Maybe we ought to have some fish fries or some Maine lobster bakes or some tuna salads in the restaurant to stir things up, Mr. Chairman. I think we probably need more showmanship than we are exerting.

Mr. HATHAWAY. Congressman Karth?

Mr. KARTH. I have no questions, Mr. Chairman.

I merely want to compliment our colleague for having the foresight some 5 years ago to recommend in part at least at that time what the Commission, after great study, has recommended in the field of oceanography and marine sciences. I want to congratulate our colleague.

Mr. WILSON. Thank you very much.

Mr. HATHAWAY. Congressman Mosher?

Mr. MOSHER. Mr. Chairman, I suggest that we on this committee are very fortunate that we have Bob Wilson in our constituency. It is good fortune for everyone interested in this problem that a Congressman in the leadership so close to the throne, so to speak, and one who is so respected and has such talents is giving vigorous attention to this problem.

I am delighted that he has been before this committee a couple of times before and is here today and I hope he will come again.

I share his feeling that we have to place a lot of hope in action from the White House in terms of an executive order through the reorganization process to bring about NOAA or some agency of that sort, as recommended by the Commission.

I think we must continue to emphasize that hope and that expectation, and I know that Bob is aware that several of us are in the process of arranging a meeting with the Vice President on this very subject at some mutually convenient time in the near future.

I am a little concerned, Bob, by the phrase in your written statement here where you say, "I am still of the opinion that the only way we can get a NOAA into being is for the President himself to push for it through a reorganization plan."

I am reluctant to say that we can rely only on the White House. That would discourage action here in this committee, and I think it is im-

perative that we move ahead on our own and take our own initiatives and vigorously support a legislative program and, even though we may hope for the reorganization plan, I think we must not wait for it. I hope you agree with that.

Mr. WILSON. I think any action by this committee in the form of legislative amendments would be helpful in the total effort, but I still stand on my prediction that the only action that will result in the formation of a new agency will be enthusiastic Presidential support in the form of an executive order. It isn't impossible by any means.

The Congress has the responsibility and the right to write legislation, but the Executive has a responsibility to administer the various agencies and, unless the President is enthusiastically behind the formation of this agency, we would be just wasting time.

Mr. MOSHER. I am sure you would agree that very vigorous bipartisan effort on the part of this committee and action and interest on the part of this committee is going to strengthen the hand of the President and encourage it.

Mr. WILSON. No question about it. I hope I haven't given the impression that I thought we were wasting time. I think we wouldn't be this far, as I told you, unless this committee had really taken an enthusiastic stance on it, and we would still be in the same situation we were 5 years ago with everybody talking about it and nobody doing anything about it.

You can just take full credit in the wisdom you had, as I mentioned earlier, in setting up the Commission and the council for the ultimate flowering of this whole idea.

Mr. HATHAWAY. Congressman Pelly?

Mr. PELLY. I want to welcome our colleague here. I think 5 years ago you and I introduced companion bills and I received the same adverse reaction from the various agencies to my bill that you did to yours. We had hearings and we moved a long way, rather slowly, but I think in a sound and progressive way.

Your statement to which Mr. Mosher took some exception about needing, in fact requiring, support from the executive branch, I agree with.

I am reminded of the so-called members of a Cabinet that met under, I think it was Andrew Jackson, and who had to deal with a problem because the wives of the members of the Cabinet wouldn't call on the wife of one individual that they didn't approve of because she had kept a boardinghouse, and the President said, "Either your wives call on Mrs. so and so or I will take all your resignations."

Somebody has to do that today to some of the members of the Cabinet because their Departments are not advising them as to what this new agency would accomplish. We recognize the role of this agency and they must become informed as well.

I have seen evidence that the Department of the Interior is very anxious to take over this responsibility, and I think it has spent a lot of money in trying to promote that idea. The Department came out with a brochure that must have cost thousands and thousands of dollars to subtly indicate that it is the agency of Government that should handle oceanography.

I don't think, unless we have very strong support from the President, that we will accomplish what we want on this, and I don't think you

need extrasensory powers to discover that in the Vice President we do have a great supporter. Mr. Mosher and I were over meeting with him only a few days ago on space matters, and I brought up the question of the entire environment and our oceanographic opportunities. He was enthusiastic and said that no nation can long continue and be a great nation if it does not explore and move out from its own immediate restrictions, whether it is space or the oceans or any other challenge.

He has a great deal of enthusiasm, and we are going to get his support I am confident.

Mr. WILSON. The Commission on Hunger that is working on the hunger problems of the country and the world ought to become interested in this idea, too, because the projections of food sources from the ocean that can be developed are just fantastic. I mean enough to feed the world.

I remember one figure where a plankton farm the size of Rhode Island could supply the food needs of the entire world, and I mean if it were developed properly and so forth.

I have never had plankton stew, and maybe I wouldn't particularly care for it, but the potential is there for us to develop. I just think that we are spinning our wheels until we really get this agency underway.

One further point, if I might: This is something that I pledged to stop today. I referred to this NOAA as a so-called wet NASA. I think that is a bad term. NOAA shouldn't be a contracting agency like NASA. It should be an operating agency, but unfortunately it was tagged with that particular name. Maybe it was good in the early stages to help explain what the basic idea of the agency was, but there is no relationship or parallel with NASA any more than between, let's say, a horse and a rabbit.

They do go through similar creative processes, but when you are through, they are completely different types of animals, and I think this is what this is going to be, too.

Mr. PELLY. Your mentioning hunger brings to mind the fact that the Merchant Marine and Fisheries Committee did report out legislation which was passed and enacted authorizing a pilot plant to develop a low-cost method of producing fish protein concentrate, but some of you Californians are going to have to help us get a little more money to get that project going because people are still starving to death. We are starving for money to get that plant built and operating.

Mr. WILSON. I think money from the Federal Government is the big need, frankly, in this oceanographic area, but it is going to be not expenditure, but investment. The returns that will come back to the Federal Government and to the community in terms of benefits provide a real opportunity for Federal investment rather than expenditure.

We are just not investing any more than pennies compared to what we should be.

Mr. PELLY. I couldn't agree more. I sometimes doubt what we are going to get any fallout from the moon but, when it comes to the oceans and the environment on our own planet, I think we can probably make the best investment.

Mr. HATHAWAY. Congressman Keith.

Mr. KEITH. Thank you, Mr. Chairman.

I am glad to have the benefit of your advice and counsel once again. I recall your earlier statement that those of us on the east coast were so afraid of this power on the west coast that we weren't too enthusiastic about you, Bob, because we were afraid that everything would go out to California.

Now I think it is resolved happily for both the east and west coasts. We appreciate your interest and support.

Mr. WILSON. Thank you. I would not suggest that branch agencies or activities might not be situated in various parts of the country, but I wouldn't give you many votes for Houston at this time.

Mr. PELLY. How about Woods Hole?

Mr. WILSON. Woods Hole is in a good place all right.

Mr. HATHAWAY. Congressman Schadeberg.

Mr. SCHADEBERG. I do want to welcome you. In the Bible, Paul makes the statement that one man sows, and the other waters, and another reaps. I hope you are in this long enough so that you can take part in all of it. You have helped sow it and water it, and I hope all of us will see the harvest.

Mr. WILSON. The parable of the loaves and fishes comes to mind, and if you remember what the Lord did with a couple of fish, he fed a lot of people.

I think we are in the same category. If we invest it properly we can use the oceans to solve a lot of the needs.

Mr. SCHADEBERG. Thank you.

Mr. KARTH. I would just like to make one statement. As long as you have already divided this basket of fruit between the east and west coasts, I suppose a gentleman like myself who comes in between those two coasts ought to just grab up his earthly possessions and go home.

Mr. WILSON. I would visualize a Humphrey-Karth memorial somewhere there in Minnesota.

Mr. SCHADEBERG. As one from the Great Lakes, I am sure we won't just let it happen that way, if the gentleman will yield.

Mr. KARTH. A memorial is something more than I had expected.

Mr. PELLY. Don't forget the Coho salmon in the Great Lakes. The fallout goes to all.

Mr. HATHAWAY. Thank you, Bob.

Mr. WILSON. Thank you, gentlemen.

Mr. HATHAWAY. Our next witness is Dr. Walter Orr Roberts.

I would like to call on Congressman Keith to introduce Dr. Roberts to the members of the subcommittee.

Mr. KEITH. Thank you, Mr. Chairman.

Dr. Roberts has kindly furnished us, as is the custom, with a biographical sketch.

I think a most interesting and noteworthy factor is that which has been added, to the résumé, perhaps for the purpose of this meeting.

Down at the bottom, it says, "birthplace—West Bridgewater," which is my hometown. The atmosphere in that community is largely responsible for the success that he has had.

His father was a close personal friend of my father. In fact, Walter and I are almost like cousins. His dad was director of athletics and coach of the football team, and ran a farm at the same time. The weather had a lot to do with the fortunes of us all in the day-to-day activity, at home, on the farm, and in the athletic world.

I always felt that Walter was interested in the atmosphere and the oceans. The time he spent at Cuttyhunk Island, also in my district, made him very conscious of the need for understanding the ocean and the atmosphere.

I am very pleased and proud to listen to him today as he comments on this momentous report, which can be so helpful to our Nation.

Thank you.

Mr. HATHAWAY. Thank you, Congressman Keith.

Dr. Roberts, you may proceed.

You have a written statement which, without objection, will be printed in the record at this point. You may either read it or summarize it; whichever you prefer.

(Biographical sketch of Dr. Roberts follows:)

DR. WALTER ORR ROBERTS

Walter Orr Roberts was graduated from Amherst College in 1938 and received his A.M. and Ph.D. from Harvard University in 1940 and 1943 respectively. He also holds honorary Doctor of Science degrees from Ripon College, Amherst College, Colorado College, C. W. Post College, and Carleton College.

Since July 1940, Dr. Roberts has been in charge of the High-Altitude Observatory at Climax and Boulder, Colorado. During this time, the Observatory evolved from a one-man operation affiliated with the Harvard College Observatory to a research division of the National Center for Atmospheric Research, of which Dr. Roberts was the Director.* He is president of the University Corporation for Atmospheric Research.

During this time he held the following appointments: Instructor, Harvard University and Radcliffe College, 1947–1948; Research Associate, Harvard University of Colorado; Professor of Astro-Geophysics, University of Colorado, 1956–60; Director, University Corporation for Atmospheric Research, 1960.

Professional societies of which Dr. Roberts is a member include Sigma Xi, American Association for the Advancement of Science, American Astronomical Society, International Astronomical Union, American Geophysical Union, Royal Astronomical Society, American Meteorological Society, American Institute of Aeronautics and Astronautics, American Acadamey of Arts and Sciences, and International Academy of Astronautics of the International Astronautical Federation.

Dr. Roberts is a member of the following boards and committees: Science Advisory Committee, Pacific Science Center; Advisory Committee, World Meteorological Organization; Board of Directors, American Association for the Advancement of Science, 1963–1966; President of the AAAS for 1968; Chairman, AAAS Committee on the Public Understanding of Science; Board of Directors, Fund for Overseas Research Grants and Education, Inc.; Geophysics Research Board of the National Academy of Sciences; Pacific Science Board of the National Academy of Sciences; Editorial Advisory Board, Journal of Panetary and Space Science; U.S. National Commission for UNESCO; Inter-Union Commission on Solar-Terrestrial Relationships, 1964–1966; and Panel 3 of the U.S. Japan Committee on Scientific Cooperation, 1963–1966. He is a trustee of the C.F. Kettering Foundation, Amherst College, and of the Fleischman Foundation.

He has served on the Councils of the American Astronomical Society and the American Meterorological Society. He has been Chairman of the Colorado Weather Control Commission, the Solar Technical Panel of the U.S. National Committee for IGY; Director of World Data Center A for Solar Activity. He was a member of the Working Committee on Solar Activity of the Comité Spécial de l'Année Géophysique International at Barcelona in 1956 and at Moscow in 1958. He was a member of the Ad Hoc Committee on International Programs in Atmospheric Sciences and Hydrology of the National Academy of Sciences during 1962–1963.

Birthplace: West Bridgewater, Mass., August 20, 1915.

*1960–68.

STATEMENT OF DR. WALTER ORR ROBERTS, PRESIDENT, UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH

Dr. ROBERTS. Thank you, Mr. Chairman, and thank you, Hastings.

I started out in my professional career as an astronomer, but some 20 years ago switched my interests primarily into the field of meteorology and atmospheric science because of my very strong conviction of the ultimate social significance of knowledge in this realm, so that I am happy to appear before your committee today representing the field of weather, and talking about its interactions with the oceans.

I am very much honored by the opportunity to appear and comment on the report, "The Nation and the Sea," prepared by Dr. Stratton and his distinguished colleagues of the Commission on Marine Science, Engineering, and Resources.

The report is, as the Chairman stated in the opening of these hearings, a monumental one, with numerous and farreaching recommendations.

With your concurrence, I wish this morning to speak briefly to one of the most important of these recommendations—that having to do with the unity of the oceans and the atmosphere as a single environmental system upon which man is heavily dependent. I then wish to make a few comments on the Commission's specific recommendation concerning the National Center for Atmospheric Research, a national laboratory operated by the University Corporation for Atmospheric Research, of which I am president and chief executive officer.

THE SCOPE OF A NATIONAL OCEANIC AND ATMOSPHERIC AGENCY

Let me turn to the first point to my testimony. I do not know, Mr. Chairman, whether your subcommittee has had opportunity to view the remarkable new motion picture film of hurricanes seen from space that has just been assembled by Drs. T. Fujita and V. E. Suomi from University of Chicago and the University of Wisconsin respectively.

If any of the members of your committee would like to see the film, I can make it available to you.

Mr. HATHAWAY. Thank you very much.

Dr. ROBERTS. If you have not seen it, it is hair raising and very instructive and exciting. Nothing that I have ever seen demonstrates so graphically the unity of the environmental system embracing the atmosphere, the oceans, and the continents.

In a few moments of time-lapse photography, this film reveals the violent vortex of a giant hurricane, and traces for hundreds of miles the cloud lines that spiral toward the eye of the storm.

It shows, for example, how minor cloud streaks from the storm sometimes develop to major squall-line storms when they cross land.

When you realize that these atmospheric monster storms, the hurricanes, can arise only from tropical oceans where the sea surface temperature exceeds 25° C., or about 75° F., you are reminded of the importance of ocean-atmosphere interactions to weather phenomena.

The Stratton Commission rightly underlines the essential unity of the ocean-atmosphere system. It is because of this unity, I suspect, that the Commission recommended the creation of a National Oceanic and Atmospheric Agency, rather than simply a National Oceanic Agency.

In recommending an integrated national atmospheric and marine sciences effort, the Commission was, in my opinion, entirely correct. Whether the physical unity of the air-ocean system necessarily means that a single administrative entity must be centrally responsible for research and resource development over the whole domain of the physical system is, of course, one of the central questions, Mr. Chairman, that I believe your subcommittee must wrestle with.

Something more than an interagency coordinating group, something more, for example, than the Interdepartmental Committee on Atmospheric Sciences in the atmosphere field, is obviously needed, because such coordinating groups tend to be ineffective in guiding programs that need integrated effort.

There are three observations, however, that I wish to make on this matter.

First, many aspects of research and development in the marine and atmospheric sciences are today lagging very seriously, when one looks at the overall national interest. Creation of something like NOAA may be able to obtain, for this area of science, a national priority commensurate with its practical potential for public benefit.

My second point has to do with something the Fujita-Suomi hurricane film graphically shows, and also something that it fails to show.

The thing that it shows is that land heavily affects the ocean-atmosphere system, even when hurricanes are involved. The effects of mountains, plains, forests, and fields are as important to the system as is the ocean. There is real action, as you all know, from giant weather systems over land, and, of course, it is over these land areas where millions of people live and work, and own property, and farm crops.

One of the things, for example, that was called to my mind by Congressman Wilson's remark is the jetstreams. These giant rivers of air, so important in air operations, are perhaps the principal factor in the development of weather systems over the Great Plains and over the central part of the United States. These jetstreams are driven, in large part, by the energy of the tropical oceans, by the evaporation in the first inch or so of the tropical oceans. The evaporation of moisture into the atmosphere provides energy that is then transported aloft and carried to higher altitudes by the general circulation of the atmosphere. This energy contributes to driving the jetstreams.

Yet, even though these jetstreams are one of the most important factors in weather over the whole of the United States, the regions from which the evaporation occurs in the tropical oceans are practically unobserved by the observation stations in operation today.

What the film does not show, and what the Commission report does not really discuss is this: that the marine sciences and the atmospheric sciences are interdependent, but they are not identical in scope or in potential usefulness to mankind.

There are many atmospheric problems of concern to mankind totally unrelated to the exploitation of the sea, and, of course, vice versa.

Therefore, the development of atmospheric science cannot be considered simply as a necessary adjunct to the development of marine science.

Each has an important role to play in the national interest, and also in any agency that incorporates the two. And in such an agency the

two must be viewed as of equal, or perhaps one should better say, of parallel importance.

My third point is that the atmospheric sciences are approaching a sense of readiness and unity that promises considerable payoffs in the next decade or two.

When one considers the atmosphere, one can think of three major areas of application: weather prediction, especially long-range prediction, which generally means anything beyond about 10 days. Second, weather modification, from its present-day modest capability of increasing runoff in western mountain areas to the more speculative possibilities of regional or continental-scale climate modification.

Third, there are the problems of conservation of the atmosphere, from local air pollution to worldwide effects of man's activities in degrading the atmosphere.

One of the things that I have been working on personally in the past few years is the clouds that sometimes form on jet airplane contrails over the continental land masses. They result from the effluent from the exhaust of the jet engines, forming thin streaks of contrail. Instead of dissipating, they sometimes grow and cover the sky. There is a possibility that these artificially induced cirrus clouds have substantial weather modifying effects on a large scale. So that when we talk about weather modification, we need to recognize that not only is it something that man might hope to do deliberately, but perhaps inadvertently we are, on some occasions, already engaged in large-scale weather modification.

To reach many of these applications, to have success in achieving these applications, we need inputs from the marine sciences, but again, these applications are not directly related to the exploitation of the oceans. Rather, they are related to the needs of people.

As you have seen from satellite pictures of weather, and also perhaps in computer-produced global patterns of atmospheric circulation, the atmospheric sciences are on the threshold of being able to cope with the world's weather as the single physical system it is.

This is the key to the greatest part of the atmospheric sciences' potential usefulness in years to come, and there is great and growing international interest in the world weather program and other efforts now underway to cross this threshold of new advance.

We have identified the central problem; namely, the problem to cope with the truly global nature of this earth-atmosphere system.

You might say that we have put the finger on the essential concept that wraps it up, and makes it possible for great advance in this field.

This is another good reason why the atmospheric sciences should not be subordinated to other areas of science in any new Federal agency, but instead should be placed on an equal basis with them. The potential benefits from atmospheric research are simply too great to be subordinated, even, to the exploitation of the sea with all its national and international importance.

COMMENTS ABOUT TRANSFERRING NCAR TO NOAA

Finally, I wish to comment very briefly about the suggestion in the Commission report that the National Center for Atmospheric Research, which we speak of as "NCAR," should be transferred to the

NOAA, once it is firmly established (page 243 of the Commission report).

As the report points out, the NCAR is an existing atmospheric science analog of the University-National Laboratories proposed to be created for oceanic science areas. NCAR is operated by the University Corporation for Atmospheric Research, a nonprofit corporation controlled by 27 member universities, whose geographical distribution spans the United States. NCAR is sponsored by the National Science Foundation.

Its primary mission is to conduct major programs of atmospheric research that embrace a scale of activity that would be too great for a single university to conduct alone. It provides major atmospheric research facilities both for its own staff and for joint use by other organizations.

For example, it operates a major high altitude balloon launch facility in Palestine, Tex. We have pioneered a very exciting globe-circling weather-balloon program, based in New Zealand, that has greatly extended our knowledge of stratospheric winds of the Southern Hemisphere, where, of course, the oceans are far more dominant than here in the Northern Hemisphere.

We also operate one of the Nation's outstanding computer centers for the simulation of global weather interactions—behind which are hidden the secrets of long-range forecasting and large-scale weather modification, if we are ever to achieve long-range forecasting or weather modification.

It is a major planning center for large cooperative world weather research programs, like the global atmospheric research program to be mounted with broad national and international participation in the late years of the next decade, and destined to be, in my view, one of the most important programs of international scientific cooperation that this Nation has ever engaged in.

It would make good sense, in my mind, to consider the transfer of support for NCAR to the NOAA only if the mission of the NOAA puts the atmospheric sciences in an adequately central position, and not simply as an adjunct to oceanic sciences, and provided the realms of atmospheric research encompassed in NOAA are sufficiently broadly interpreted.

I should interpolate here that my remarks should in no way be interpreted as being critical of NSF's sponsorship of NCAR, however. NSF has provided strong and effective backing for the National Center for Atmospheric Research, even though NCAR has been subject to the budgetary limitations that have been imposed on the NSF, and this has slowed our program substantially.

If you compare the NOAA report with the activity of NCAR and the 27 universities with which NCAR is associated, it is clear that our concept of the atmospheric sciences is far broader than the concept of the atmosphere envisaged in the NOAA report.

Much of NCAR's strength comes from its broad concept of atmospheric science, reaching even to other planets and to the sun.

NSF has provided fertile ground for this new concept. This broad view of the atmospheric sciences extends from the surface of the earth into the very high atmosphere and beyond. This concept embraces the influences of the sun on the earth's atmosphere. It takes into

account the effect of mountains and land areas on the atmosphere. It embodies a concern for severe land storms like tornadoes and hailstorms. It puts atmospheric chemistry in an important position.

Such a broad view is an essential ingredient for progress toward great practical usefulness. Any narrowing of this scope would decrease the relevance of atmospheric research to primary national goals.

NOAA's sights should be set as high as this. If the incorporation of NCAR into NOAA would help guarantee such a broad scope in the concept of the atmospheric components of NOAA, it might work to the benefit of the whole country, and to the position of this Nation in world science.

Thank you, Mr. Chairman.

Mr. Hathaway. Thank you, Dr. Roberts, for a very enlightening statement.

I presume you mean that you go along with the Commission's recommendation, which says that NCAR should be incorporated into NOAA eventually, but you think it should not be immediately.

Dr. Roberts. I think it would be useful for NCAR to be incorporated into NOAA, if the agency adheres to the broad concept of the atmosphere that would embrace atmospheric environmental pollution control and the many other fields of atmospheric science, which the Commission report has not recommended be incorporated, at least at the outset, into the new agency.

For example, there are areas of work in the Bureau of Reclamation, Department of the Interior, and there are areas of work in the Public Health Service having to do with air pollution chemistry, that the Stratton Commission report does not recommend for inclusion in NOAA. Without the inclusion of these equally integral parts of the atmospheric science in the National Oceanic and Atmospheric Agency, I believe the NOAA concept becomes inadequate, and that the agency itself becomes insufficiently comprehensive.

Mr. Hathaway. Thank you.

Dr. Roberts. I feel similarly about certain parts of the NASA weather program, as well.

Mr. Hathaway. Congressman Keith.

Mr. Keith. We noted, and the Commission also has noted, the many diverse parts of the oceanography effort, and the extraordinary costs and duplication. Is there a parallel in the field of atmospheric research?

Dr. Roberts. Yes, sir. In the oceanic sciences, I believe the Commission report states there are 22 Federal agencies, with overlapping interests.

In the atmospheric sciences, there are, I believe, some 16 agencies involved; the difficulty of coordination and the fractionation of the support for major programs among different agencies and among different committees are quite parallel to the situation in the marine sciences. In fact, I am very much attracted to the idea that was suggested in these hearings yesterday, that perhaps what is needed is a reorganization that would create a Department of Resources and Environments, of which perhaps NOAA would be one component.

Mr. Keith. In developing our arguments for this, it is helpful to talk of costs and possible savings. Would it be difficult to draw up a letter that would outline the nature and extent of these duplications and possible efficiencies, or has the Commission done it adequately as it pertains to the atmosphere?

Dr. ROBERTS. The Commission has not confronted this in a comprehensive way for the atmospheric sciences. It has compared relative costs, and outlined the costs of the components that it has recommended putting into the NOAA.

However, the Interdepartmental Committee on Atmospheric Science and ESSA have both made extensive studies, and I believe the National Science Foundation also has done this, of the total funds going into atmospheric science areas under present Federal programs, including the very extensive weather services of the Department of Defense.

The Defense applications of atmospheric science, it must be obvious to anyone, are extremely important, particularly in the long-range forecasting and forecasting for remote regions of the world, so that the total costs that are now being expended within the Federal Government for atmospheric sciences are a matter of record, and they are very, very substantial.

Only a small fraction of these Federal activities in atmospheric science have been recommended for inclusion in NOAA. However, it would be quite easy, using these various reports, to develop a recommendation that would, for example, show a distribution of activities for what I would consider to be an appropriate NOAA, and to show where areas of overlap might possibly be avoided in such an agency. One could also put a price tag on the present work, and the recommendations for the future.

It would be a larger figure than that shown in the Stratton Commission report, partly because of the inclusion of a larger range of atmospheric science within the agency, and partly because of the need for incremental funds for some of the major, coordinated programs leading toward long-range forecasting. The global atmospheric research program, for example, has not been considered by the Stratton Commission.

Mr. KEITH. I would think that would be helpful data for us to have, as we approach the time when we really have to make a strong stand on it.

Dr. ROBERTS. I would be glad to provide, speaking just for myself, and for my own organization, a view of what this might be.

Mr. KEITH. If the Chairman concurs, I think it would be very helpful to have that.

Mr. HATHAWAY. Yes, Doctor; if you submit that, we would be glad to incorporate it into the record.

Dr. ROBERTS. Thank you, sir.

(The information requested follows:)

ANALYSIS OF PRESENT PROGRAMS IN ATMOSPHERIC SCIENCE, BY FEDERAL AGENCY, WITH RECOMMENDATIONS REGARDING CONSOLIDATION WITHIN AN APPROPRIATELY CONSTITUTED OCEAN-ATMOSPHERE AGENCY, JUNE 4, 1969

Planned FY 1970 funding for scientific research in the atmospheric sciences, as reported by the Federal Council for Science and Technology [1] totals approximately $202 million, and involves efforts in 10 different federal departments and agencies. This level should be compared with actual funding of atmospheric research of over $248 million in FY 1968. In spite of heightened priority of public interest in such socially important goals as weather modification, air pollution control, and improved long-range weather forecasting, funds for underlying research in this field have declined.

[1] Interdepartmental Committee for Atmospheric Sciences Report No. 13, January 1969.

Services and operations in the relevant domains of the atmosphere will require approximately $342 million in FY 1970, according to a report of the Office of the Federal Coordinator of Meteorology.[2] Chief among these are the world-wide Air Weather Service, under the Department of Defense (operational funds requested in FY 1970: $144 million) and the U.S. Weather Bureau of ESSA, under the Department of Commerce (operational funds requested in FY 1970: $108 million). The remaining $90 million is spread among eight other agencies and departments.

ATMOSPHERIC SCIENCE ELEMENTS FOR INCLUSION IN A BROADLY CONSTITUTED OCEAN-ATMOSPHERE AGENCY

In my view, if an agency were to encompass the nation's interest in the sea and the atmosphere, it would include a large proportion of the atmospheric research supported by the various Federal Agencies, and would, in addition, include operation of the U.S. Weather Bureau. It would exclude the operational atmosphere-related services of the military, and some portion of R & D directly supporting those services.

The major portion of my remarks below refer to research, rather than operations, since I am familiar with our national research needs in this area. However, as the Stratton Commission wisely indicated with regard to the oceans, research and operational services both belong within the concept of an adequately broad ocean-atmosphere agency.

Listed below are the major Federal Agency research programs that should be considered for inclusion in an appropriately broad ocean-atmosphere agency. For each agency, I list the planned FY 1970 budgets[3] and comment on the desirability of inclusion in the agency. The views expressed are solely my own, and are based on my current knowledge, which is not exhaustive. A comprehensive study should, of course, precede final judgment.

(1) Department of Agriculture, FY 1970: $1,783,000

Research in water-management, forest fire meteorology, and programs in forest-air-earth interactions, including climatology of forest and crop environments. In my view these programs should be included in the ocean-atmosphere agency if it is formed.

(2) Department of Commerce, FY 1970: $19,124,000

Support of research in the Laboratory Astrophysics Division of the National Bureau of Standards and also in the varied research programs of the Environmental Science Services Administration should be included in the agency. This should include the major parts of the funding for the Global Atmospheric Research Program, an important international research program for which ESSA now has lead-agency U.S. responsibility.

In my opinion, the Global Atmospheric Research Program probably should be singled out for special scrutiny by the Congress, and should obtain a very high priority as a national goal—with earmarked funds and special periodic review by Congress. GARP should be a goal of the ocean-atmosphere agency comparable to NASA's present goal of a successful moon landing.

Included in the Department of Commerce are many important research functions, such as the pioneering work of the Geophysical Fluid Dynamics Laboratory, which merits increased support. Research on hurricanes, tornadoes, climate modification, severe thunderstorms, satellite meteorolgy, and several related areas justify continued or enhanced support. The Stratton Commission report does not, however, clearly identify what parts of the ESSA research programs it seeks to encompass in N.O.A.A.

It is particularly important that studies of the very high atmosphere, generally labelled aeronomy, be included in the ocean-atmosphere agency and that they be pursued with increased vigor. These researches involve the interaction of the earth's atmosphere with phenomena of solar and cosmic origin. Not only must these researches be extended, but there needs to be a closer contact between scientists in these realms and those working in lower-level meteorology.

(3) Department of Defense, FY 1970: $62,832,000

There are many important programs in the DOD atmospheric science effort. The DOD concept is broad, extending to solar physics research, such as the observation and theoretical study of solar flares and their effects on the earth. In this

[2] Federal Plan for Meteorological Services and Supporting Research, fiscal year 1970, Office of the Federal Coordinator of Meteorology, ESSA, 1969.
[3] ICAS, *op. cit.*

regard, the programs are very fitting for inclusion in the agency, though the Stratton Commission did not so recommend.

There are some parts of the DOD program that are closely enough related to the specific military needs of the agency, that it might be better to have them stay with DOD. Without more extensive study, I cannot make a firm recommendation as to which parts should be transferred to a new ocean-atmosphere agency. I suspect, however, that it would be in the overall national interest if these components, at the very least, transferred:

(a) Work on mathematical modelling and on the large-scale circulation of the atmosphere.

(b) Fundamental work in cloud physics and cloud electrification.

(c) Studies of the solar spectrum, both experimental and theoretical, including stellar and solar modelling.

(d) Most of the aeronomy and solar physics work, including the outstandingly successful solar-terrestrial studies, and related space-environmental studies.

(e) The Arecibo Ionospheric Observatory work, with its uniquely powerful and important radar and radio astronomical research capabilities.

(*4*) *Department of Health, Education, and Welfare, FY 1970: $7,315,000*

Air pollution abatement is a central problem of atmospheric sciences, and it seems to me essential to include the support and extension of such programs within a properly constituted ocean-atmosphere agency. Its pursuit must go hand in hand with research on atmospheric dynamics, diffusion, and turbulence. This area of work must gain vastly expanded support, and with it must come improved focus and quality of effort. This work was not encompassed by the Stratton Commission recommendations, but I believe it must be included if an ocean-atmosphere agency is created. However, it may be more practical to leave the establishment and enforcement of air pollution standards in HEW, especially those related to health standards.

(*5*) *Department of Interior, FY 1970: $5,550,000*

Most of the researchers now carried on under the atmospheric science programs of this department seem to me to be of central interest to a properly-constituted ocean-atmosphere agency.

Rainfall augmentation is a central goal of the Interior programs today. This goal is intimately related to the problems of hail suppression, lightning suppression, and climate-modification. I believe all belong within a single well-coordinated agency.

(*6*) *Department of Transportation, FY 1970: $470,000*

The DOT programs in atmospheric science are rather directly tied to the needs of the air-traffic-control system of the nation. In my view this probably puts them in a category of such close relevance to the agency's mission that inclusion within the new agency will not result in substantial benefits. However areas of research having to do with "mountain waves" and their relation to "clear air turbulence," of great importance to aviation, should be conducted within the ocean-atmosphere agency and should be intensified.

(*7*) *Atomic Energy Commission, FY 1970: $7,249,000*

Much of the AEC's work in atmospheric turbulence and in dynamic meteorology, it seems to me, could be effectively brought within a broad ocean-atmosphere agency. Some of the specific trajectory work for radioactive fallout, on the other hand, should probably remain an AEC responsibility.

(*8*) *National Aeronautics and Space Administration, FY 1970: $70,243,000*

The best division of responsibility between NASA and a properly constituted ocean-atmosphere agency is a difficult matter to recommend. However, the problem requires a direct confrontation and solution. If NASA orients its post-Apollo thrust towards the earth applications, then meteorology and atmospheric sciences generally offer promising public benefits through space applications, and it may be that an appropriately large and focussed effort will materialize most effectively and economically if these efforts are kept within NASA. If, however, earth-directed applications research, and specifically if the meteorological programs continue to play a very subdued, second-fiddle role as compared with man-in-space programs, meteorology should probably be removed from NASA and centralized in a new agency. If this is done, it should embrace all aspects of space-based meteorology now in NASA except, perhaps, actual vehicle design and launch. The

continuing lowering of support to atmospheric programs within NASA ($130,982,000 in FY 1968 to $70,243,000 planned for FY 1970) strongly contrasts to the increasing public interest and potential benefit from effective use of space technologies for atmospheric studies, one of the most promising areas in all of modern science.

(*9*) *National Science Foundation, FY 1970: $27,300,000*

The NSF programs in the atmospheric sciences, generally speaking, should probably remain with the agency. NSF's mission is to promote the advancement of basic science in all disciplines, and the atmospheric field should not be singled out as an exception.

NSF now has responsibility to support the National Center for Atmospheric Research as well as the research grants programs. Over the past three years the NSF atmospheric program has remained essentially level, in spite of vast and growing public concern with air pollution, weather forecasting, and a host of other atmospheric problems. This funds freeze has had adverse consequences. For example, NCAR has been stopped far short of the major facilities and research goals that have been set by widely-based planning studies, and for which there is very strong evidence of national interest and benefit. It may prove necessary to provide sponsorship of the new ocean-atmosphere agency, to the National Center for Atmospheric Research in order to make it possible for NCAR to acquire and operate the necessary facilities and do the appropriate research. This should not, however, be taken as criticism of NSF, which has had severe limitations to work under. Within these limitations, the mode of NSF sponsorship has been very beneficial to NCAR.

NCAR's FY 1970 budget plan constitutes approximately 40% of the NSF atmospheric science budget; it is included as a line-item in the budget request to Congress for the NSF.

(*10*) *Federal Communications Commission, FY 1970: $25,000*

This is a nominal program, and I do not suggest any change in its support. It is closely related to the FCC mission.

SUMMARY

Summing up these recommendations, I would include within a broadly-constituted ocean-atmosphere agency the atmospheric science programs of three agencies whose FY 1970 budgets total $26.5 million and part of the atmospheric science programs of five agencies whose FY 1970 budgets total $105.2 million. These figures do not include NASA, pending a determination of the importance of earth-related programs in the post-lunar U.S. space program.

Since many existing programs are at sub-critical levels when the national interest is considered, I estimate that the atmospheric research portion of a properly-constituted ocean-atmosphere agency would require an annual budget averaging between $200 and $300 million per year over the next five years (not counting NASA atmospheric research functions, which may be added on); and that the budget of the U.S. Weather Bureau, which stands now at approximately $108 million for FY 1970, should also be included, at a substantially higher figure, in a properly-constituted agency. If NASA atmospheric science functions are included, the operational and research aspects of the atmospheric sciences in the new agency would then require on the order of half a billion dollars per year for the next five years. In addition, as much as $100 million per year would be required for support of the atmospheric research and development in existing agencies.

I wish to emphasize that the recommendations that I have made here are the product of my own thinking only, and that they are not the result of a detailed critical study of the appropriate bounds of a viable new ocean-atmosphere agency. The recommendations do, however, reflect my own strong view that not just a part, but all of the atmospheric sciences, as well as the atmosphere-related services, should be integrally involved in a national agency that nominally encompasses the oceanic and atmospheric environments of the earth. I sincerely hope that Dr. Stratton's excellent Commission can be re-constituted with broader environmental representation, or that some other broadly representative Commission can be brought into being, to extend the concept so excellently outlined by the Stratton Commission for the oceanic portion of the earth-air-ocean environment of man.

Mr. KEITH. Does this University Corp. for Atmospheric Research have a coordinating role? Is there any improved correlation of atmospheric research data because of this?

Dr. ROBERTS. Yes, sir. I think it is fair to say so.

Mr. KEITH. Representing, as I do, Woods Hole, and knowing what they have recently done in the field of education, I wonder if there is not perhaps a need for a similar organization in the field of oceanography, or does one already exist?

Dr. ROBERTS. No; such an organization does not now exist in the field of oceanography. But in the atmospheric sciences, the University Corp. for Atmospheric Research has as its members, 27 universities comprising almost all of the major universities in the country that have atmospheric research programs and graduate study going on in the atmospheric sciences.

As a consequence, it represents, you might say, a voice of the principal part of the academic community in the atmospheric sciences.

As such, it is a principal planning agency for major programs in which the universities seek to participate. It also provides major research facilities that are too large for a single university to provide, but which can be used by all universities.

I might add that many of the facilities are also used by Federal agencies, so that the facilities, the advisory services, and the planning activities of the National Center for Atmospheric Research and the Corporation that runs it are available in the total national interest. Even advisory services to private industry in respect to atmospheric research are available from NCAR.

Mr. KEITH. What is its budget?

Dr. ROBERTS. The budget at the present time is approximately $14 million, of which approximately $12 million comes from the National Science Foundation.

Mr. KEITH. What is its physical plant? Does it have a central location, as such?

Dr. ROBERTS. Yes, its central headquarters are at Boulder, Colo., and it has major facilities also in Palestine, Tex.; Page, Ariz.; Climax, Colo., in the high mountains; in Hawaii; and in New Zealand, and it has field operations that extend to many places.

At the present time, for example, NCAR is a participant in the Bomex (Barbados Meteorological Experiment), a major program organized by ESSA in the Barbados, to study tropical atmospheric circulation over the warm oceans in the summer.

Mr. KEITH. Mr. Hathaway, I think this is an organization that we might visit. I like some of their locations.

Mr. HATHAWAY. I do, too.

Dr. ROBERTS. I have a picture of your next meeting place, which I will be glad to leave with you, Mr. Chairman.

Mr. KEITH. Thank you, Mr. Chairman.

Mr. HATHAWAY. Mr. Schadeberg.

Mr. SCHADEBERG. I want to welcome Dr. Roberts and tell him how much I appreciate his testimony.

I am beginning to know how little I know, and how much there is still to learn.

I am sure as NOAA gets into being that certainly things that were left out or should be changed will be taken care of as we go along. Of

course, it is better to know beforehand how much is involved. I am sure there will be many, many changes that will go on as we go along.

Thank you very much.

Dr. ROBERTS. Thank you, sir.

Mr. HATHAWAY. Thank you very much.

There is one question I want to ask you before you leave.

Although consolidation of functions is an admirable objective in almost any field, the argument is made in certain cases that there is an advantage that we have in fragmentation from the competitive element involved.

For example, you have the various manpower training programs being conducted today by the Department of Education, by Labor, by OEO, and some say we ought to consolidate and save money, but others say let's leave them as they are, because we get new ideas from the competitive element of these three agencies competing in that one field.

Do you think we might make a mistake in this area by consolidating all atmospheric agencies in one agency, and lose the competitive advantage?

Dr. ROBERTS. I realize that there are advantages to a certain measure of separation, but in respect to the creation of the NOAA, I believe that the advantages from consolidation of many atmospheric science functions that are not now recommended for consolidation outweigh the disadvantages.

In particular, there are areas of atmospheric research that involve weather modification, that are so integrally related to the problem of prediction as the character of the winds over the mountains, that to separate these into two separate agencies means that programs that should be carried on in a coordinated way have to go to separate agencies to receive separate components of the funding. They have to be defended before separate committees, and the total program that needs to embrace four or five cooperative efforts by separated agencies is only as strong as the weakest link in the particular defense of the particular component.

Right now, for example, in northeast Colorado, NCAR is organizing—and I wish I had time to tell you the history of this—what we are calling the northeast Colorado hail experiment.

The Russians demonstrated some years ago that it appeared to be possible to suppress 90 percent of the hail in a major thunderstorm by firing antiaircraft shells into the lower part of the thunderstorm.

We have decided in the United States, with NCAR playing a principal role, and with the support of the Interdepartmental Committee on Atmospheric Science and the National Science Foundation, to mount what I like to call a Chinese copy of a Russian experiment, to see whether American thunderstorms behave the way they appear to do over the collective farms of the Soviet Union, and see whether it is possible to suppress hail over northeast Colorado.

It involves coordinated components of support from ESSA, from the Department of the Interior, from the Department of Agriculture, from the National Science Foundation, military support for the aircraft, and a number of other things.

Now, to bring these together, and to get the funding through the separate committee structures that are involved, means, in spite of

all good will on the part of the Interdepartmental Committee on Atmospheric Science, a terribly great struggle, and the program threatens to slip from year to year for want of funding of some particular component.

I feel that a single agency, seeing the national importance of this cutting across many fields of interest, would make the funding for this come along more promptly, and allow it to be spent in a more effective way.

Mr. HATHAWAY. Thank you very much, Doctor.

Are there any further questions?

The subcommittee will adjourn until next Tuesday morning at 10 o'clock, when we will hear Dr. Sidney R. Galler and Mr. Walter C. Beckman.

(Whereupon, at 12 o'clock noon, the subcommittee adjourned, to reconvene at 10 a.m., Tuesday, May 27, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

TUESDAY, MAY 27, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY, OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:15 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of subcommittee) presiding.

Mr. LENNON. The subcommittee meeting will come to order.

This morning we resume our hearings in review of the report by the Commission on Marine Science, Engineering, and Resources, entitled "Our Nation and the Sea."

There are two witnesses scheduled for this morning. The first will be Mr. Walter C. Beckmann, chairman of the board and president of Alpine Geophysical Associates, Inc. As you recall, Mr. Beckmann was here prepared to testify last week but unavoidably we had insufficient time to receive his testimony. He very graciously agreed to reschedule his appearance for today's hearing. And we appreciate his cooperation. I am sure his testimony will be both interesting and enlightening as he is certainly outstanding in the field of applied oceanography.

Although we have heard from previous witnesses associated with industry, Mr. Beckmann will be the first to speak directly from the standpoint of an oceanographic corporation and the scope of its activities.

Our second witness this morning is a distinguished friend of this subcommittee—a noted marine biologist and Assistant Secretary for Science of the Smithsonian Institution—Dr. Sidney R. Galler. When Dr. Galler was invited to appear, it was wtih the understanding that his testimony would reflect his personal views and not those necessarily of the Smithsonian Institution. It is of course our intention to call on the Smithsonian later, when the various Government agencies are heard.

Gentlemen, we are delighted that you could be with us this morning. We will be happy to receive your statement now Mr. Beckmann, and I will ask unanimous consent that immediately preceding your statement a career résumé of Mr. Beckmann appear in the record.

Good morning, sir. We are delighted to have you and regret that we do not have a better attendance of members. We have been doing some checking and find that many of the members of this committee are on other committees now in executive session of reporting out their annual authorization bills, and that is the explanation for our short attendance.

We are delighted to have your statement. You won't be subject to as many questions. Go right ahead please.

(The information referred to follows:)

CAREER RÉSUMÉ OF WALTER C. BECKMANN

President and Chairman of the Board, Alpine Geophysical Assciates, Inc., Norwood, New Jersey 07848, 1959–1969.

Research Associate in Oceanography, Lamont-Doherty Geological Observatory (Columbia University) Palisades, New York, 1949–1959.

Columbia College. B.A. 1949, Majors in Physics and Mathematics, New York, New York, 1945–1949.

Professional Affiliations: American Fisheries Institute, American Geological Union, Catfish Farmers of America, European Society of Exploration Geophysicists, New York Academy of Sciences, Marine Technological Society, Seismological Society of America, Society of Exploration Geophysicists.

STATEMENT OF WALTER C. BECKMANN, PRESIDENT, ALPINE GEOPHYSICAL ASSOCIATES, INC.

Mr. BECKMANN. Mr. Chairman and gentlemen, it is indeed a pleasure for me to appear before the subcommittee to express the views of Alpine Geophysical Associates, Inc., concerning the report of the Commission on Marine Science, Engineering, and Resources.

The Commission must be congratulated on its report. Basically Alpine supports the recommendations made by the report. Some of these are particularly significant to Alpine and I would like to comment briefly on some of them.

I am Walter C. Beckmann, president and chairman of the board of Alpine Geophysical Associates, Inc., of Norwood, N.J. Our company is a leader in applied oceanography. We began our brief history in 1959 and note our first decade of operations this year 1969.

Our group has distinguished itself by introducing to the offshore and land petroleum exploration industry the use of nonexplosive sources of seismic energy—this means that the techniques we have introduced do not kill fish—but equally important, provide a better means of finding oil.

We have found oil in the Persian Gulf, the Cook Inlet, the North Sea, the Gulf of Mexico, and on the Alaskan North Slope. Our techniques and crews have proven offshore geophysical exploration for mining: coal, diamonds, iron ore, tin, manganese, among others.

We have introduced the use of tankers to carry bulk cargoes such as grains and ammonium sulphate.

We are the first and only company in the world to make marine protein concentrate (MPC)—which is a fish protein concentrate (FPC)—and is perhaps one of the principal means of preventing mass world starvation.

Alpine was the largest industrial contractor, for oceanographic surveys, of the U.S. Naval Oceanographic Office, prior to last year's budget cut. Of three marine geophysical survey contracts, let by Navoceano, we were awarded two—the third went to Texas Instruments.

It might be well to note here that, when the Agency for International Development of the State Department decided to obtain fish protein concentrate for their humanitarian projects some 350 persons, representing U.S. and foreign corporations, attended the bidders' con-

ference, but Alpine was the single and only bidder. We were awarded the contract to provide over 2 million pounds of marine protein concentrate (MPC) to AID.

I have a few simple points to present to this distinguished group. Oceanography is often compared to space, in fact such terms as inner-space and wet NASA are commonplace. However as an oceanographer and moreover as a commercial oceanographer I note one big difference between space and the oceans: Space holds no profit motive for private industry—other than the design, development, and fabrication of hardware.

While, in contrast, the oceans hold considerable profit motive for industry. We do not seek development of hardware, we—industry—seek the exploitation of the oceans. The exploitation of the oceans should be by private industry, using private capital.

We, as the oceanographic industry, compete with many Government supported academic research programs—which are in reality, rather poorly performed and inefficient oceanographic studies carried out by university students.

As you all know last year's budget cuts have made considerable inroads into oceanography. Industry will need considerable help to continue its progress in the oceans. We feel that the Government needs to help private industry—help by initiating fewer big Government supported programs using unnecessarily expensive and inefficient research vessels.

Put this money into joint academic, industrial, and Government programs where the unique capabilities of each group are utilized to the maximum.

We, at Alpine, believe that the national projects recommended by the Commission are well conceived. I would recommend the operation of such research, development, testing and evaluation facilities to be by private industry, on a cooperative arrangement with Government and the academic community.

As examples, Alpine has been engaged in two such projects, which have been perhaps the most efficient application of taxpayers' dollars in oceanography. The first of these was the International Indian Ocean Expedition. Here the U.S. Navy provided a ship which was converted, by Alpine, to a biological oceanographic research vessel using Government funds—in this case provided by the National Science Foundation.

The vessel, which was formerly President Truman's yacht, was renamed the RV *Anton Bruun*, and was operated by Alpine using a regular union crew. Alpine was responsible for a basic scientific staff who performed routine oceanographic measurements and maintained the equipment.

Scientists from Government agencies and from academic institutions, both domestic and foreign, participated on a grant basis, with funding by NSF, and with overall scientific planning and programming by the Woods Hole Oceanographic Institution.

The program went extremely well and a follow-on project along the west coast of South America was also carried out. Unfortunately, the *Bruun*'s useful life has expired. NSF has run short of funds and she is to become a seaside restaurant in New Jersey.

We have been engaged during the past 6 years in a similar project aboard the NSF Antarctic research vessel USNS *Eltanin*. In this case the vessel is MSTS owned and operated, the scientific support staff is made up of Alpine personnel and scientific programs are manned by university scholars under National Science Foundation grants.

Administration, including that of the grants, is carried out by Alpine.

I mention these examples to point out that a three way joint effort in specific mission oriented programs can be accomplished effectively and efficiently. I suggest that the National Science Foundation structure is a better example for a national agency than either the Coast Guard or the Department of the Interior.

We are interested and encouraged to see that the Commission has recommended the establishment of the National Oceanic and Atmospheric Agency. We are in favor of such an agency if it is a new agency with its own responsibilities and authority and of course its own funding.

If it is to be a rehashing of existing agencies to enable the creation of yet another bureaucracy I think it be best left uncreated. It is most important that the new agency have access to a scientific body, or steering group which can plot its overall objectives and contribute to long range planning, both in the initial stages of development and on a continuing basis.

I am certain that with the continued excellent guidance of the House Merchant Marine and Fisheries Committee we may all achieve our objectives in oceanography.

Mr. LENNON. Thank you, very much, Mr. Beckmann. The gentleman is recognized.

Mr. SCHADEBERG. Thank you, Mr. Chairman. On page 3 you stated:

> I would recommend the operation of such research, development, testing and evaluation facilities to be by private industry, on a cooperative arrangement with Government and the academic community.

Mr. BECKMANN. Correct.

Mr. SCHADEBERG. First of all, my question is, Do you think that private industry is capable financially, or willing to assume the costs of research for development of equipment that may have to be used? I am interested more or less in your interpretation of what this cooperation between Government and the academic community would be, in what areas and to what extent.

Mr. BECKMANN. I think as far as the first part of the question asking whether or not industry will develop the equipment; industry has shown that it will develop the equipment.

As far as our own company is concerned, we develop relatively smaller pieces of equipment which have an almost immediate commercial application, but of course the larger members of the industrial community like the Lockheeds, and Westinghouses, and so on, have put a lot of money into developing submersibles. Some have done it just for publicity and some have done it with a serious intent to utilize these vehicles in the future. They have to be in the future because there is certainly no market for the submersibles now.

There are approximately, 60 submersibles and about once every two months one gets a decent opportunity to do something.

I would like, if there are going to be any extensive facilities, to see them run the way the Atlantic missile range was run by Pan Am. I think that routine surveys are better run on a commercial basis in order to reserve the academic community to investigate into pure research.

Mr. SCHADEBERG. I can understand and appreciate this because I do believe personally, of course, that private industry should get the maximum responsibility at least and efforts and benefits, but I think I am aware that this may be the case: that as you look into the future there may be new tools besides the submersibles themselves, new equipment and tools needed for specific work and I don't know much about it but some of it may be at considerable cost and I am wondering whether private industry would be in the position of assuming the cost of development of these tools.

Maybe I am looking too far ahead at the moment.

Mr. BECKMANN. I think I can say, in line with what you are saying, that where industry needs the maximum help is in the development of exotic instruments for which there is no need today but where there will be several years down the road. How much industry is going to take over that sort of thing I would think would be at a minimum.

Mr. SCHADEBERG. That is all, Mr. Chairman.

Mr. LENNON. Thank you, sir. Mr. Hanna from California.

Mr. HANNA. Thank you, Mr. Chairman. I noticed in your presentation, Mr. Beckmann, that you refer to a contract that you were awarded for over 2 million pounds of FMPC.

Mr. BECKMANN. Yes, sir.

Mr. HANNA. Has that all been delivered now?

Mr. BECKMANN. No. Delivery is to start at the end of this month.

Mr. HANNA. It will start the end of this month. What was the price arrived at?

Mr. BECKMANN. Forty-two cents a pound.

Mr. HANNA. Forty-two cents a pound. Where are the plants located?

Mr. BECKMANN. This plant is located in New Bedford, Mass.

Mr. HANNA. In Massachusetts.

Mr. BECKMANN. Yes.

Mr. HANNA. I was surprised to see that you were the only bidder there. There are some other firms that I have heard mentioned.

Mr. BECKMANN. We were extremely surprised that we were the only bidder at the time, but since that time I have found out that nobody else makes it, that there are no other plants.

Mr. HANNA. I am trying to remember that name that was quite strong in the field for a while. It seems to me that it was from up in New England some place.

Mr. SCHADEBERG. Will the gentleman yield?

Mr. HANNA. Yes.

Mr. SCHADEBERG. Are you referring to human consumption?

Mr. HANNA. Yes.

Mr. SCHADEBERG. I know that many industries make it for meal for cattle. I think there is one in Milwaukee.

Mr. HANNA. I know there were a number making it for cattle, but there were also some that indicated they were making it for human consumption.

The other thing I wanted to refer to in your testimony is on page 3, where you indicated that the Government needs to help private industry, "by initiating fewer big Government supported programs using unnecessarily expensive and inefficient research vessels."

Would you care to be a little more specific as to what you had in mind in that particular statement. Did you have in mind any particular activity that we have initiated?

Mr. BECKMANN. Yes, I think one of the things that has occurred in oceanography, say, in the last 5 years is that the greatest expansion in oceanography has come from taking existing vessels and putting them over into a budget called oceanography rather than ship operations.

The oceanographic community went on a program which defined a 10-year expansion effort to build many, many research vessels. It has accomplished that purpose and has built many, many research vessels. The only thing that everyone forgot was that the vessels require scientists to work on the data and that the vessels become rather all consuming when the budget cut gets a little tight, so that we now find ourselves, at the present time, continuing to build large vessels costing over $10 million, $10 million to $15 million, yet cutting our programs at the National Science Foundation and Navoceano, and so on. All these programs were operating vessels that cost about $1 million.

Therefore, I feel strongly that at the present time we have far more vessels than we can utilize and we don't have enough money to operate the vessels that exist.

Mr. HANNA. Then what you are talking about is that more money should now go into operational programs rather than development of expensive vehicles.

Mr. BECKMANN. I think that is right, yes. I would like to see the attitude of oceanography turned around a little bit to be mission oriented. Pick out a few of the recommendations in the report and do them.

I agree you can't do oceanography without vessels, but when the vessels get to be so large that they are overpowering the accomplishment of any work, I think it is wrong.

Consider Lamont Observatory at Columbia whose budget is about $7 million a year, Woods Hole about the same, and Scripps about $10 million, and then talk about building research vessels for $13 million or $15 million apiece, I think that this is out of proportion.

Mr. HANNA. You feel that there is more return on the investment if we can go now in terms of putting the eyes and ears and talents to work on a specific mission.

Mr. BECKMANN. Yes. I think that is very definitely right. I think you can see that with the work that the *Glomar Challenger* has been doing with the essentially shallow coring problem in the ocean.

Mr. HANNA. I think that was the point that Jacques Cousteau was making at the oceanography meeting a few years ago when he pointed out that it was very important to have the man present who drives the vehicle because he provides the eyes, and he told the story of the remarkable bull in Spain where there was this tremendous example of the bull which looked like it was admirably suited for the ring. He took it to the ring but he said, "Unfortunately, bull, you cannot see. You cannot tell the difference from the picador, the matador and the cuspidor. Everybody is so sad."

But there was an optometrist. He said, "I fix." And he ground the contact lenses for the bull and, "The bull was very, very much a champion-type bull and can tell the difference immediately between the picador, the matador, and the cuspidor, but he cannot see the grass and die."

So that the presence of the eyes and the ears is very important and I am delighted to hear the gentleman emphasizing the importance of missions because I concur in that statement.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Hanna.

The gentleman from Michigan, Mr. Ruppe.

Mr. RUPPE. Thank you. Thank you for your very informative statement. On the first page you mentioned the use of nonexplosive sources of seismic energy. I wonder if you would comment on that a little.

Mr. BECKMANN. In what regard? What they are?

Mr. RUPPE. Right; what they are and a little bit on the technique used.

Mr. BECKMANN. Well, there is a family of them now. Basically the principle is that of making a small noise or many small noises and adding the echoes up from these many small noises rather than using one large explosion.

The devices are used in reflection techniques which are used to determine structure beneath the ocean bottom and, working very similarly to the echo sounder, provide a chart which provides a graph of the layers beneath the ocean bottom.

There have been a dozen or so sound sources that have been used. These include the Sparker, which is simply a small spark discharge in the water, a gas exploder which is a small explosion of oxygen and propane, and there are a few mechanical ones, the Hydrosein, the Vibroseis, and the air gun, but the basic principle is that of making many small explosions and using computers to add up the many small explosions to replace one large one.

Mr. RUPPE. The explosion used does not affect the fish population in any way.

Mr. BECKMANN. That is correct.

Mr. RUPPE. I am not clear on the distinction between marine protein concentrate and fish protein concentrate.

Mr. BECKMANN. Marine protein concentrate is a trade name of our company and fish protein concentrate is the generic term.

Mr. RUPPE. I wonder if you might give me an indication of the type of work in general and the goals of the effort behind the work of the two vessels mentioned, the *Anton Bruun* and the *Eltanin*.

Mr. BECKMANN. The *Anton Bruun* program: The primary objective was to contribute to our understandings of the life cycle of the fish and plankton of the Indian Ocean to determine whether or not there is a possibility of an economic fisheries in the Indian Ocean.

Mr. RUPPE. Were you able to go far enough with this research program to make a final determination as to the potentials of the fishery?

Mr. BECKMANN. I believe the answer to that is yes, but the problem is who is going to fish it. Of course, most of the Indian Ocean lies adjacent to India and fishing bases could be set up in India and developed. That becomes a very difficult thing to do as compared to the problem of figuring out the ecology of the ocean.

The *Eltanin* program is primarily an oceanographic and atmospheric vessel or platform which has been working in the Antarctic waters for about 8 years and has gone approximately around half of the Antarctic. The program is being performed on a systematic basis. It determines the depth of the water, the geologic structure, physical oceanography, studies the water column, birds, fish, plankton, and the upper atmosphere.

Mr. RUPPE. Will the work of the *Eltanin* have any particular or direct application as far as American commercial or industrial or scientific endeavor is concerned or is it almost a pure research project?

Mr. BECKMANN. It is a pure research project at the present time and even just figuring out the depth of water is pretty good because we don't know how deep the water is any place around the Antarctic or know little of the configuration at the bottom or any other features.

There are many things that will be learned which will give us a first crack at learning a little about the Antarctic. Major discoveries are made in the Antarctic, such as the fact that the hills are really mountains and are not piles of ice, has been made within the past 10 years.

Mr. RUPPE. The work done in the Indian Ocean does seem a little remote from our own shores or our own applications. Has similar work been done on the Atlantic and Pacific coasts in matters that might offer opportunities for American fisheries and exploitation of same?

Mr. BECKMANN. Yes; there has been a lot of work done both by Scripps on the west coast and by Woods Hole on the east coast in addition to other research organizations. I mention those two because they have been performing such programs for 25 or 30 years.

In addition the Bureau of Commercial Fisheries does a lot of this type of work.

Mr. RUPPE. I have some question of the value I suppose of the effort expended in the Indian Ocean. It does seem that if the vessel were still operative working there that the potential of the applications for future commercial activity would be very limited.

Mr. BECKMANN. I don't think that is right because I think, the way the fishing industry is today, any place you could find fish in quantity, you would be willing to go to get them.

You see the expedition of the *Bruun* wasn't solely for commercial fisheries, but the study did ascertain the fisheries population in the Indian Ocean.

Mr. RUPPE. Was a determination finally made as to the composition of that fishery? Was it carried to a conclusion?

Mr. BECKMANN. Yes; to the extent that one can learn in 2 years with one boat.

Mr. RUPPE. Has the study resulted in any particular new applications or the utilization in any different way of that particular fishery?

Mr. BECKMANN. There are several companies, Indian companies—a lot of this work as done in conjunction with Indian scientists—that are working in the Arabian Sea harvesting fish that they had not previously harvested.

You know that an answer to your question is that the problem has more to do with other aspects of social, economic, and political factors than it has to do with oceanography or fisheries.

To the same extent that it is impossible to start a cattle industry in India, for example, because people don't eat cows, you have a similar trouble with fisheries. People don't particularly like fish because they have never had fish before.

Mr. RUPPE. I have no further questions, Mr. Chairman.

Mr. LENNON. Thank you. Counsel?

Mr. DREWRY. Mr. Beckmann the *Anton Bruun* was one of a number of ships participating in the international Indian Ocean expedition; was it not?

Mr. BECKMANN. My recollection is that there were about 40 or 50 ships altogether.

Mr. DREWRY. And a large number of nations were involved in it on a cooperative basis.

Mr. BECKMANN. Yes, I think about 14 nations altogether.

Mr. DREWRY. And the studies were multidisciplinary, were they not?

Mr. BECKMANN. Yes.

Mr. DREWRY. Not just looking at fish, but trying to find out a lot of things.

Mr. BECKMANN. The mission was to study the Indian Ocean from as many disciplines and aspects as was possible.

Mr. DREWRY. Thank you.

Mr. LENNON. Mr. Rogers.

Mr. ROGERS. Thank you, Mr. Chairman. Mr. Beckmann, I read your statement and I think it points up something I am concerned with and I think the committee probably is too, and that is the lack of a proper utilization of the industrial capability.

I think you have made this point very forcefully in your statement. It seems to me that we have put such stress on the academic in research, feeling that all research has to go through an academic institution that we have bypassed the usage of private industry in a cooperative effort, and I think and hope that this will be corrected in our approaches and I would think this committee would be interested in seeing what it can do to encourage greater use of our industrial capability in research so that we do have the joint effort of the Government and industry and the academic community all working together.

I think your point is well made and I agree with it.

Thank you.

Mr. BECKMANN. Thank you.

Mr. LENNON. Thank you, Mr. Rogers.

Mr. Beckmann, you called our attention to the fact that your company was awarded this contract to provide some in excess of 2 million pounds of MPC or what is really fish protein concentrate, FPC.

How much of that 2 million pounds, since this contract was entered into, have you delivered to the AID?

Mr. BECKMANN. On the order of, I believe, less than 2 tons. We have only delivered as requested by AID for use in some of their market studies. We have not begun delivery of the bulk order.

Mr. LENNON. But you have a contract for 2 million pounds.

Mr. BECKMANN. Yes.

Mr. LENNON. And that contract was entered into when?

Mr. BECKMANN. Well, I know delivery is due this month and we had a 9-month delivery schedule. Nine months ago.

Mr. LENNON. In other words, some 9 months ago.

Mr. BECKMANN. Yes.

Mr. LENNON. Over what period did your contract provide for the delivery that you have been referring to of the 2 million pounds?

Mr. BECKMANN. I believe it was within an additional 9 months.

Mr. LENNON. Do you anticipate that you will actually deliver and receive payment for 2 million pounds within this period of time?

Mr. BECKMANN. I do now, yes.

Mr. LENNON. Do you now have and have you had a capability to make this delivery much earlier than you have been called on to make it?

Mr. BECKMANN. No, we have not.

Mr. LENNON. You have not had the capability?

Mr. BECKMANN. No.

Mr. LENNON. In other words, you are saying to the committee that it is your judgment that you will actually deliver 2 million pounds to AID of fish protein concentrate.

Mr. BECKMANN. Yes, it is.

Mr. LENNON. Now, that has a very fine nutritional value, doesn't it?

Mr. BECKMANN. Yes.

Mr. LENNON. That is basically what it is. Can you sell that in this country? We need it badly, everybody says. Our people are not hungry from lack of food, but from lack of nutrition and everybody agrees that this is an ideal food additive for that purpose.

Can you manufacture it and sell it commercially in this country?

Mr. BECKMANN. At the present time, we are restricted to sale in the United States in containers smaller than 1 pound.

Mr. LENNON. In containers smaller than 1 pound. Is that the Federal Food and Drug Administration's requirement?

Mr. BECKMANN. Yes, sir.

Mr. LENNON. But they have approved this particular protein, haven't they?

Mr. BECKMANN. Yes, sir. It is approved for human consumption and we are restricted on the size of the package in which we can sell it.

Mr. LENNON. Why is that? If it is needed and everybody says it is needed and it ought to be used in meal and grits, hominy, bread, and so many, many things, why is it that you can't use it in this country? The Federal Food and Drug Administration has approved it for sale overseas and yet we won't let our own people use it. Is it the aroma or flavor? You ought to know because you make it and try to sell it.

Mr. BECKMANN. I don't know of anything in the product that results in this restriction.

Mr. LENNON. What has been done, is what concerns me, to change this restriction. Has anyone at the executive level made an effort to try to change the policy restricting the sale of it in boxes of a pound or less.

Mr. BECKMANN. We have made applications to FDA, we, as a company, and have had assistance from the Bureau of Commercial Fisheries, and our estimate on the length of time that is required to get approval of this change is of the order of 18 months to 3 years.

We have talked with Food and Drug, specifically with Dr. Ley, who I think is interested in making some real progress in this direction.

Mr. LENNON. Now, after Food and Drug has approved it as to the quality of the product it does not have the authority to say in what size package it has to be delivered, does it, or does it?

Mr. BECKMANN. Well, I think the answer is "Yes" on two counts. Yes it can say the size package you put it in, it can say the labeling on the package and it also says what you can add it to.

For example, FDA sets up a definition of simple words like bread, flour, with a certain specific specification. In other words, if you deviate from the specification of bread you can no longer call it bread.

Mr. LENNON. In other words, what you are saying to the committee is that you can't sell it to General Foods or any of the other manufacturers who use it in their various food products, can you?

Mr. BECKMANN. No; we cannot unless we are willing to ship it in one pound bags and then of course the onus comes on them as to what they do with it.

Mr. LENNON. Of course you are forbidden to do that by the Federal Food and Drug Administration.

Mr. BECKMANN. Yes.

Mr. LENNON. That is specifically for the record. This committee after the Food and Drug Administration approved this product, I guess it was in about February or March of last year, wasn't it?

Mr. BECKMANN. Yes, sir.

Early this year we called on the new Chairman of the National Council, Vice President Spiro Agnew, and the new Cabinet members who were members of the Council to see if they could remove this packaging restriction. Everybody says we need this protein, that it ought to be sold to all of the manufacturers in the country who are making food products.

Who is blocking this thing? Who has the authority to say that as much as this particular product is needed that it can't be sold and our people shouldn't have the nutrition that we seem to be willing to furnish the people of the world free through AID.

Do you have any comments on that? How do you think we can move this thing or don't you want to move it? Do you want to sell this stuff in this country?

Mr. BECKMANN. Yes; we most definitely do. I know our present course of attempting to make progress in this area is to select one or two products on which we could get a change of product specification.

Of the two that we are presently looking at, one was suggested by Dr. Ley, that is tortilla flour, which is a corn flour, and as far as providing animal protein, is essentially useless to eat.

The other product is macaroni. Each of these products lend themselves very well to the addition of fish protein concentrate.

Mr. LENNON. Don't you think, sir, that it is rather disgraceful that we say to people all over the world, "Here we make a product in our country fit for human consumption, which has high nutritional value and we need it in our country but we won't let our people have it. It is just not good enough for our people in our affluent America, but it is good enough for you people." What do you think?

Mr. BECKMANN. I agree with that completely. I think the thing that bothers me most is when my own children come home and, because they are too lazy to do anything else, open a box of cereal. This happens

about eight times a day up until midnight. I wish I could buy a cereal that had FPC in it so I could feel at least they received some protein and get a little nourishment.

Mr. LENNON. We are passing a bill today that carries in it several hundred million dollars to feed the school lunch programs, the poor, the elderly, and yet we can't use something in this country because, well, it smells a little fishy. But they have eliminated that fishy smell, haven't they, completely?

Mr. BECKMANN. Yes, sir; and when it is used in a concentration as recommended in products, you don't know that it is in there at all. I am sure most people here have had various breads or desserts or something like that made with it.

Mr. LENNON. I am going to ask unanimous consent to put in the record at this point the letter that I wrote to the Vice President urging him to use his influence and urging all the members of the Cabinet who were members of the National Council to try to change this policy. I would also like included the letter that I wrote to the President calling his attention to the possibilities of using FPC in his fight on hunger and malnutrition.

(The letters follow:)

HOUSE OF REPRESENTATIVES,
Washington, D.C., March 20, 1969.

Hon. SPIRO T. AGNEW,
The Vice President, The White House,
Washington, D.C.

DEAR MR. VICE PRESIDENT: The Subcommittee on Fisheries and Wildlife Conservation of the House Committee on Merchant Marine and Fisheries conducted hearings on Fish Protein Concentrate (FPC) last summer at the request of the Bureau of Commercial Fisheries for the need of additional funding to construct a research pilot plant to develop new and less expensive processes for producing FPC.

For years, we have been told how FPC can be used to fight hunger and malnutrition throughout the world. At this time, we are in the process of sending $900,000 worth of FPC to fight malnutrition in Chile. However, here in the United States, FPC cannot effectively be used to combat malnutrition because Food and Drug Administration regulations require that FPC be marketed in one-pound packages or less.

Testimony developed before our Subcommittee revealed that Dr. James L. Goddard, the then Commissioner of the Food and Drug Administration, had indicated a willingness to waive the one-pound packaging restriction on FPC if the food additive were used in a Government sponsored program to combat malnutrition.

Like you, I am keenly interested in the fight against hunger and malnutrition in this country. We now have a plant in New Bedford, Massachusetts, that can produce FPC that will meet the quality standards of the Food and Drug Administration. This product could be used here to help alleviate the malnutrition we are told exists in our country.

Several federal agencies would be involved in any developed feeding program using FPC as a food additive. It seems to me that you, as Chairman of the National Marine Council on Marine Resources and Engineering Development, could best coordinate and further such a worthwhile program.

I will be glad to assist and cooperate with you in this proposed program.

With kind regards.

Most sincerely,

ALTON LENNON.

THE VICE PRESIDENT,
Washington, April 10, 1969.

Hon. ALTON LENNON,
House of Representatives,
Washington, D.C.

DEAR MR. LENNON: Your letter of March 20 expressing your interest in the fish protein concentrate program is greatly appreciated. The contribution of food from the sea—and particularly FPC—in combating malnutrition at home and abroad is high on the agenda of the National Council on Marine Resources and Engineering Development.

The Marine Sciences Council is reviewing the entire FPC program, including the one-pound packaging restriction on the sale of FPC in the United States. I therefore have asked Dr. Edward Wenk, Jr., the Council's Executive Secretary, to keep you informed of developments.

May I take this occasion to say how much I appreciate how your interest and support in marine science affairs has contributed to progress so far, and that I look forward to talking with you personally about future advances.

Sincerely,

SPIRO T. AGNEW.

MAY 8, 1969.

The PRESIDENT,
The White House,
Washington, D.C.

DEAR MR. PRESIDENT: Like you, I am keenly interested in the fight against hunger and malnutrition in this country. As a member of the Merchant Marine and Fisheries Committee. I have been most interested in the development of fish protein concentrate (FPC) as a food additive in the fight against malnutrition.

As you know, FPC is still in its formative state and last year Congress authorized funds for the construction of a pilot plant on the West Coast. The sum of $300,000 is being expended for the design and construction plans of this facility, and the Bureau of the Budget is holding $675,000 of the project funds in reserve pending an additional $900,000 to complete the plant. This last item is not in your Budget.

Our national needs are varied and great, I realize, but I simply wanted to call your attention to the possibilities of using FPC in the fight against malnutrition both here and throughout the world. Perhaps this resource could also become a part of your proposed fight to combat hunger and malnutrition.

With kind regards,

Most sincerely,

ALTON LENNON.

THE WHITE HOUSE,
Washington, May 15, 1969.

Hon. ALTON LENNON,
House of Representatives,
Washington, D.C.

DEAR MR. LENNON: Thank you for your May 8 letter to the President concerning hunger and malnutrition. We appreciate having your suggestion to use fish protein concentrate as a food additive and your comments are now receiving careful consideration.

With cordial regard,

Sincerely,

WILLIAM E. TIMMONS,
Deputy Assistant to the President.

Mr. SCHADEBERG. One thing I would like to have clear on a point of information is, is this a meal of itself that would replace wheat or others or whatever it is maybe, or something that you add to it?

Mr. HANNA. It's an additive.

Mr. BECKMANN. Look at it another way. There are various ways of storing fish, fresh on ice for 2 weeks, or you can freeze them and hold them 6 months or a year, FPC is a means of storing fish with a shelf life of, say, 5 years. It is in a powder form which is white and has a little bit of odor, not objectionable.

The question comes up: What does one do with it? The only thing we know to do with it, is to make an additive, to add to a soft drink, for example, or add to flour to make the dough, or into macaroni (which is essentially flour).

Mr. SCHADEBERG. The reason I asked it is that I know from some of the farm organizations and from some of the agricultural industries that there has been a tremendous amount of opposition to it because there is a fear that it will replace the agricultural product, rightly or wrongly.

I might also add, Mr. Chairman, that I don't know what the source is, but I read about 2 or 3 years ago that India was to get some of this through AID and they refused to accept it because it wasn't on our own shelves. I don't know how true that was. Has any of this been delivered that you know of to India?

Mr. BECKMANN. No. To the best of my knowledge, none has ever been made.

Mr. SCHADEBERG. Mr. Chairman, I have one other question if I may ask it. In a previous hearing we had testimony from Mr. Boggs of the Ocean Harvesters, Inc., and Mr. Levin from the Viobin Corp. Are these in your organization?

Mr. BECKMANN. Viobin is the corporation which developed the process which we use to make the FPC.

Mr. SCHADEBERG. But they don't manufacture it?

Mr. BECKMANN. They do not manufacture it.

Mr. SCHADEBERG. How about the Ocean Harvesters?

Mr. BECKMANN. That is a new one on me. I never heard of it.

Mr. HANNA. Mr. Chairman, would you yield further?

Mr. SCHADEBERG. I am finished.

Mr. HANNA. I appreciate this because I, with the Chairman, have entertained a long-term interest in this problem and before I came on the committee was one of the members of Congress personally jousting with the people downtown about this whole problem.

I take it that there are several problems associated with this business, one of them being economic. If it costs 42 cents a pound on the basis of a 2-million-pound delivery it would appear to me that there are some market problems in adding this concentrate to just any product. It would be more acceptable to put it in a product that is so cheap that it could easily absorb in the process the small amount of protein concentrate in the larger amount of something like flour that is put in tortillas, is that not correct, and macaroni, for instance, which is a very cheap product which could spread out the higher price of the concentrate to the lower price of the basic commodity?

Has that got something to do with it?

Mr. BECKMANN. Yes. There are two points. One is at the present time the 42 cents is a guessed price. We don't know what it really does cost to make.

The second one is that one should realize that 42 cents a pound for animal protein is extremely cheap because in the normal price of a piece of fish you pay for 83 percent water. FPC is dried to about 4 percent water or moisture content.

Mr. HANNA. In other words, it is a concentrate?

Mr. BECKMANN. Yes.

Mr. HANNA. And I think that answers Mr. Schadeberg's question because obviously this is not anything like wheat because it is really a concentrate. What you had stored as fish is stored as a concentrate and certainly would be no substitute for flour. No one is going to bake with protein concentrate.

It seems to me that what we should do is to get the story to the wheat-growers that this is something that would make wheat have a broader market because it would add protein.

In other words, you could have a fish sandwich without even having the fish in a sense, having it built right into the bread.

The other thing is: Do I understand that you can't deliver this thing in anything larger than a pound bag?

Mr. BECKMANN. That is correct.

Mr. HANNA. This would mean that if you were going to push this thing at all, you would be almost thrown completely out of the institutional market and all you could do is to go into the stores, and I personnally know how much it costs to try to bring a new product on the line in any kind of a marketing situation through the various retail outlets. That is a tremendous investment in terms of pushing a single product, is it not?

Mr. BECKMANN. Yes, it certainly is.

Mr. HANNA. So that that almost is precluded on the basis of the marketing facts of life, right?

Mr. BECKMANN. Yes, but we are going to try anyway.

Mr. HANNA. I wish you luck because I know what that is like, believe me.

Mr. BECKMANN. I know it isn't going to be easy.

Mr. HANNA. I have gone into the freeze dried coffee thing about 7 years ago with a small company, and we never got any place, but I notice Maxim with some real clout behind them could do something on that market. I wish you well.

I would certainly commend the chairman in terms of his interest and say that, if there is anything I can do, Mr. Chairman, to support your position, I will certainly do it.

Mr. LENNON. Your contract is for 2 million pounds?

Mr. BECKMANN. Correct, sir.

Mr. LENNON. You have delivered you say up to this date approximately 2,000 pounds?

Mr. BECKMANN. On that order, 2,000 or 3,000 I believe.

Mr. LENNON. In that area, you have another 9 months to go on your contract to consummate the delivery of the balance of the 2 million pounds?

Mr. BECKMANN. I believe it is 9 months or 6 months.

Mr. LENNON. I wish you would ask AID for a statement as to what nations they intend to furnish FPC and insert that in the record immediately following our colloquy on this subject.

(The information follows:)

DEPARTMENT OF STATE,
AGENCY FOR INTERNATIONAL DEVELOPMENT,
Washington, D.C., June 18, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, House of Representatives, Washington, D.C.

DEAR CONGRESSMAN LENNON: Thank you for your letter of May 29, 1969 in which you asked for a status report on the contract A.I.D. awarded to Alpine Marine Protein Industries, Inc. (a wholly-owned subsidiary of Alpine Geophysical Associates, Inc.) in April, 1968 to provide A.I.D. approximately 970 metric tons of fish protein concentrate (FPC) for $900,000.

The contract called for delivery of 320 metric tons by January 26, 1969 and the balance by July 26, 1969 and included a liquidated damages clause in case these delivery dates were not met. In October, 1968 Alpine requested a four-month extension of these delivery dates. The extension was granted because it was deter-these delivery dates were not met. In October, 1968 Alpine requested a four-month period. The new delivery dates were set at May 26 and November 26, 1969. However Alpine was unable to deliver as scheduled on May 26. Although several attempts have been made by Alpine to supply small quantities of FPC for A.I.D.-sponsored market studies, the FPC produced did not meet the required specifications. To date, no FPC has been delivered to A.I.D. under the contract. Accordingly, A.I.D. has given written notification to Alpine that damages are assessable under the liquidated damages clause of the contract in the absence of facts to support an excusable delay. This clause requires that Alpine "shall pay to A.I.D. by way of compensation, and not as a penalty, liquidated damages for delay in delivery at the rate of two percent (2%) per thirty (30) day period of price of undelivered amount for each thirty (30) day period or fraction thereof of delay commencing on the first day after the date in which delivery is required under the contract or any extension thereof, and continuing until the date of actual delivery or the date of termination of the contract." We are enclosing a copy of the contract and amendment as well as a copy of A.I.D.'s letter to Alpine, dated June 8, 1969, regarding the liquidated damages.

As you know, A.I.D. helped in initiating this pioneering attempt to produce FPC on a commercial scale and we fully expect delivery under this contract. Alpine reports that it has produced a substantial quantity of first stage material, which awaits final processing. The final processing facilities are completely installed and are now being tested. Once the plant is fully operative, it is expected that Alpine should be able to meet its first delivery commitment, now estimated to be September 1, 1969.

Once received, A.I.D. will utilize the FPC in projects developed pursuant to the enclosed Guidelines which were sent to Registered Voluntary Agencies and A.I.D. Missions abroad. The proposals received were prepared and have been evaluated in accordance with the criteria set forth in the Guidelines. A preliminary review of these proposals indicates that Brazil, Colombia, Dominican Republic, Chile, India and Korea offer the best opportunities for Phase I of the program. The information developed from Phase I will be used to program the second delivery of 650 metric tons of FPC.

Your deep and continued interest in this program is appreciated. We will be pleased to supply you with any additional information you would be interested in receiving.

Sincerely yours,

MATTHEW J. HARVEY,
Director, Congressional Liaison Staff.

GUIDELINES FOR USE AND EVALUATION OF AID PROCURED FISH PROTEIN CONCENTRATE (FPC)

(By Food From the Sea Service, Office of War on Hunger, Agency for International Development)

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I. GENERAL FACTS ON FPC

AID has been given the major responsibility for developing FPC as an effective weapon in the battle against hunger and malnutrition in developing countries. As one aspect of its development program, AID has agreed to purchase approximately 970 metric tons of FPC from Alpine Marine Protein Industries, Inc.

FPC, as processed from whole fish, is a highly nutritious (75–80% protein and 14% useful minerals) powdered fortification ingredient with a bland fishy taste, and a slight odor. FPC is *not* a food per se. It is an ingredient used to fortify the protein content and value of flour and flour products, corn and cornmeal products, and other cereal grain and vegetable based products.

This fortification not only provides additional protein but also a better balance of amino acids, the so called "building blocks" of proteins, thus it increases the availability of the proteins present in the fortified food product. For example, tortillas have ⅓ the protein value of milk (when compared in the standard protein efficiency ratio (PER) test). However, if 5% FPC and 5% de-fatted soy flour are added to this corn based food, the PER increases to about the same as milk—with no effect on the taste of the product.

The nutritive value of FPC has been demonstrated in clinical trials on infants, children, and adults. These studies have shown that FPC supports normal growth and has a nutritional value equivalent to fresh fish, milk, meat, and eggs.

According to these studies, fortification with FPC in the range of 5–10% of the dry weight of the product being fortified is sufficient to provide significant nutritional enhancement without affecting consistency, stability and taste acceptability. Pasta, breads and other bakery products, beverages, and soups and gruels are good vehicles for such fortification. Mixing FPC into food products, such as flour, for shipment overseas is not being done at this time pending obtaining final data from technical studies being performed on the stability of such mixing.

II. DELIVERY SCHEDULE/AMOUNTS AVAILABLE

AID experts that FPC will be available as follows:
330 metric tons, August 1, 1969.
640 metric tons, November 26, 1969.

III. UTILIZATION AND EVALUATION PROGRAM

The purpose of this program is to identify the food products normally eaten by the general population of selected less developed countries and to measure the acceptability of these foods when fortified with FPC. For this reason it is necessary that the food products proposed for FPC fortification have relevance to the diet of the people of those countries or regions, or sections thereof. To obtain this goal the program will be carried out in two phases keyed to the above delivery schedule. Proposals for individual countries may be submitted for each phase in accordance with the criteria detailed below.

A. Phase I (330 tons)

Phase I is essentially a pilot phase to determine product formulae for FPC fortification of *pasta, bread and other bakery products, beverages,* and *soups and gruels,* and to evaluate their acceptability. Phase I is restricted to the use of these products because present knowledge indicates that they are the best vehicles for such fortification.

Approximately 130 of the 330 tons of FPC available on August 1, 1969 will be allocated to Cooperating Sponsors (Voluntary Agencies, Recipient Governments, and Intergovernmental Organizations) for selected programs in a few countries that use these products. In selecting these programs priority will be given to those operating under plant like conditions or with central processing facilities. These stringent criteria and target concentrations are necessary in order to control and monitor the product fortification, its distribution, and subsequent evaluation. Consistency in fortification and distribution should provide an opportunity to obtain valid and significant evaluation data.

AID will provide field assistance and guidance for the use of this 130 tons of FPC and for the evaluation of such use.

AID sponsored nutritionists and/or food technologists in cooperation with Cooperating Sponsor personnel and host country counterpart, to the extent the host government desires to participate, will assist in product formulation and tests with the products proposed for fortification in this phase. Concurrently, an AID evaluation team will refine the general evaluation procedures for each program, implement it, oversee the data gathering, and analyze the information generated.

In this phase evaluation will be concerned with three general areas; (1) Consumer acceptability, (2) Product Stability, and (3) Packaging requirements. Specifically, we want to determine if FPC fortified products are as well accepted as non-FPC fortified products; what effect different levels of FPC have on flavor, cooking, texture, color, etc.; and what, if any, packaging is needed to assure product stability.

The remaining 200 tons is tentatively programed for use in Chile, Korea, and Morocco to complement A.I.D.'s FPC feasibility studies, as detailed in C below.

B. Phase II (640 tons)

Approximately 170 of this 640 tons is tentatively programed for Chile's school feeding and maternal and child welfare programs.

The formulae developed and the acceptability determined in Phase I will be useful in allocating the remaining 470 tons to the Cooperating Sponsors for Phase II. Although some evaluation will be attempted in Phase II, Phase II programs will not be subjected to the same degree of control and evaluation as Phase I. The final shaping of Phase II will be guided by the experience and information obtained in Phase I.

C. FPC feasibility studies

As a result of worldwide preliminary surveys conducted by A.I.D., Chile, Korea, and Morocco were selected as the demonstration sites for the FPC feasibility studies. A contract has been awarded for the Chile and Korea portion of these studies and steps are being taken to award a contract for work in Morocco.

The general objective of these studies is to determine if FPC fortified food products are acceptable to protein deficient and malnourished people and if viable FPC industries can be established. These studies will be used as a guide to investment-decision-making in FPC and other related food industries.

Chile.—The 300 tons of FPC tentatively programed for Chile will be made available to a point of contact within the Chilean Government who will control its distribution and use. Any Cooperating Sponsor proposal submitted for Chile will be forwarded to this point of contact, once it is officially established, for review and approval.

Korea.—The Korea portion has been completed and a final report is being prepared. Since product development and testing was not performed as originally planned under the contract, A.I.D. is especially interested in receiving proposals that might provide some insight into the potential acceptability of FPC and FPC-fortified food products in Korea.

Morocco.—The main objective of the Morocco study will be to evaluate and determine the market potential for FPC and FPC-fortified food products in Morocco in four market areas:

(1) Fortification of staple foods directed toward protein deficient target groups;

(2) Development of infant and weaning foods enriched with FPC;
(3) Development of foods for institutional feeding programs; and
(4) Market testing selected foods from 1, 2, and 3 to determine commercial potential.

Proposals for Morocco will be reviewed in terms of how they might fit into these areas.

D. Proposal submission

Proposals for both phases should be submitted at this time and should include, but not necessarily be limited to, the following information:

(1) The name of the country and the pertinent phase to which the proposal is directed;

(2) A complete description of the program for which the proposal is directed; i.e., the program's location within the country; the facilities and personnel available; the magnitude of the program; a breakdown of the age groups involved and the approximate number in each group; the foods the group eats and the foods proposed for fortification with FPC, *including a statement as to whether these foods are relevant to the normal dietary pattern of the country or section;* any comments as to the kind of evaluation procedures that might be useful for each specific program; and any other pertinent information or comments;

(3) The proposed length of the program including a time phasing or scheduling chart showing when FPC and other requirements are needed. Phase I may (according to the time span proposed for the selected programs) continue past the beginning of Phase II;

(4) An important consideration in proposal submission is the general rule that one (1) metric ton of FPC at 10 grams/day/child feeding levels will feed about 3,300 children for one month.

E. Deadline for proposal submission

Please submit your proposals by May 23, 1969. Direct these proposals and any questions to: Mr. George K. Parman, Director, Food From the Sea Service, Office of War on Hunger, AID, Washington, D.C. 20523. Telephone: Area Code 202 343–2391 or 343–2641.

In his absence, Mr. J. B. Cordaro, of his staff, will be able to provide any assistance that might be required.

IV. WRITTEN AGREEMENT

AID will enter into cooperative agreements with each organization that will assist in this program. These written agreements will detail the allocation, distribution, programming and evaluation procedures.

V. ADHERENCE TO GOVERNMENT REGULATIONS

This program is not a part of the PL 480 program and the regulations that govern PL 480 are not applicable herein. Any legal requirements that must be adhered to will be discussed with each organization and detailed in the written agreement noted in IV above.

VI. PACKAGING AND SHIPPING DETAILS

The FPC used in Phase I will be packaged in fifty (50) pound multiwall bags with a polyethylene insert. (This is the same bag used for non-fat dry milk).

FPC will be shipped, on Government Bills of Lading, to East Coast ports. Overseas shipment costs will be borne by the recipient country or the Agency which is to handle its distribution. Registered Voluntary Agencies may be reimbursed, according to the usual procedures, for transportation costs of the FPC by authority of Section 216 of the Foreign Assistance Act of 1961, as amended.

Appendix

Essential Technical Data on FPC

I. COMPOSITION

The composition of FPC varies somewhat according to the fish used but all U.S. produced FPC must meet the standards set by the Federal Food, Drug, and Cosmetic Regulations (FDA)—that appeared as Section 121.1202 of the Federal

Register of February 2, 1967 and is herewith attached to this appendix as 1. A typical sample contains the following major components:

Protein, 75 to 85 percent.
Fat, 0.3 to 0.5 percent.
Ash, 9 to 15 percent (mostly calcium and phosphorus).
Carbohydrates, 0.1 to 0.4 percent.

II. SPECIFICATIONS WAIVED

The AID procured FPC is subjected to rigid inspection and conforms to all but two provisions of the above mentioned regulations. These concern packaging and fluoride level (refer to Sections 121.1202(c)(6); (d); (e); (f)(2)). Specifically,

A. The requirement for packages not to exceed one pound net weight reflects a domestic matter, does not relate to any public health aspect, and is not germane or pertinent to overseas use.

B. The FDA requirement for fluoride level is a maximum of 100 ppm. AID has set, after consultation with experts, a permissible maximum fluoride level of 250 ppm.

III. BACKGROUND ON FLUORIDE CHANGE

The level of 100 ppm of fluoride, which can be attained only by expensive deboning, was determined administratively by the FDA on the basis of a possible cosmetic affect from long-term feeding of high levels of FPC. There was no concern about any possible toxic effect.

If a child is fed FPC as 10% of its total protein intake daily from the age of six months to 12 years, and assuming a level of 250 ppm of fluoride in the FPC, the amount of available fluoride ingested per day during this period will be from 3 to 5 mgs per day. At this level of intake, there may be some slight mottling of teeth after several years continuous feeding. The letter from the Food and Nutrition Board of the National Research Council attached to this appendix as 2 summarizes the opinion of a special expert committee; namely, that as much as 8 mg. of fluoride per day for a life time will have no serious effect, and on the contrary may be regarded as beneficial.

IV. A LEGAL REQUIREMENT

Despite the lack of hazard associated with these changes the fact that they differ from the FDA standard necessitates that in any country in which the FPC will be used, A.I.D. must ascertain that written approval has been obtained from the appropriate Ministry before shipment can be made.

V. USE OF FPC IN FOODS

FPC can be added to a variety of foods. The amount needed to supplement a protein deficient diet depends upon the composition of the diet itself. In general, an inclusion of 10–20 grams of FPC per day will greatly improve the quality of the diet.

Adding FPC at levels of 5–10% of the flour used in cereal foods and at similar levels in other food, has no discernible effect on flavor and texture. FPC fortification recognizes the persistence of food habits and is used only to improve food nutritionally while at the same time retaining the conventional taste, color, and textured qualities of the food fortified.

Some examples:

(*A*) *Pasta products.*—All forms of pasta products, spaghetti, macaroni and noodles, etc., can be supplemented with FPC. The proportion of FPC to flour per kilogram of mixture is given in the following table:

[In grams]

Supplement level	FPC	Flour	Animal protein in 3½ oz. (100 gram mix)
0 percent	0	1,000	0
3 percent	30	970	3
6 percent	60	940	6
9 percent	90	310	9

The addition of FPC up to 6% level may cause a little darkening of the dried pasta. At 9–12% levels the darkening is more noticeable. As the usage levels of FPC increase, more water than is normally used is required to attain cohesiveness with the FPC-flour mixtures. For example, the addition of FPC at a 6% level, requires approximately 5% more water than non-FPC mixtures. The addition of FPC gives no appreciable changes in texture. If 9–12% FPC is used in the formulation, there will be a faint characteristic FPC odor during the first few minutes of processing and cooking. At lower levels of FPC supplementation, no unusual odor is detectable during processing and cooking. Pasta that contains up to 9 per cent FPC tastes no different from non-FPC fortified pasta, whereas at the 9–12% level the taste is "different." The acceptance of this "difference" may vary from locale to locale.

(*B*) *Bread and other bakery products*

A mixture of 5% FPC and 95% wheat flour can be used in place of plain wheat flour in a standard bread or roll recipe.

If more FPC is used in the formulation, changes must be made in the preparation. For example, the amount of water used may have to be changed to produce the desired texture. With increased amounts of FPC, the color of white loaves darkens and the loaf volume decreases further. Bread made containing FPC is similar in appearance to whole wheat bread. The texture of the bread tends to become more crumbly as the amount of FPC increases. The flavor of the bread is very good.

A mixture of 10% FPC and 90% soft wheat flour (cake flour) can be used in place of the white flour in making cakes, cookies and similar foods. Water should be used instead of milk, since the use of milk tends to result in a toughening of the cookies or cakes. Depending upon the nature of the wheat flour, the amount of water added has to be adjusted.

The use of FPC in the formulation affects the degree of sweetness. At the 10% level of FPC, there is a slight decrease in sweetness.

The addition of FPC grays the color of baked products but the effect is only slight and not sufficient to make them objectionable.

(*C*) *Soups and gravies.*—In general, one teaspoon of FPC (approximately 2.5 grams) to a cup of soup or gravy (about 200 milliliters) can be added with minimum change in the original product. The FPC should first be mixed to a smooth paste with a small amount of cold water, then some of the hot soup or gravy added to it. The fineness of the grind of FPC is especially critical in these products, since a coarse product will give a slightly gritty feel to the product fortified.

VI. FPC STORAGE

FPC is a stable, dry powder which can be kept under any conditions suitable for storage of other powdered foods. Excessive heat or dampness must be avoided as in the case of other bagged materials, but special storage conditions such as refrigeration are not needed. Normal food sanitation handling should be practiced to avoid contamination by other substances, dirt, foreign materials carrying infections, insects, birds and animals.

Mr. LENNON. Now, Mr. Beckmann, may I ask you this question specifically? I assume when I ask you this question that you have read and given some serious thought to the Commission's recommendations with respect to a governmental structure. What type of organization or governmental structure do you feel would best be suited for a national agency?

Mr. BECKMANN. I believe it should be an agency that is made up of two bodies. The first is a scientific steering committee that would define goals and determine priorities, and the second would be a nonoperating body which would implement programs by providing the funds to academic, industrial, and Government operating units.

I stress the nonoperating organization aspect of such an agency because I feel that the last thing oceanography needs at this time is another group of expensive vessels and facilities. We should make use of the vessels and facilities that we presently have, many of which are now idle.

Mr. LENNON. That reminds me of a hearing that was held in this room on June 21, 1961, by this same committee on oceanography. The Committee on Oceanography actually had been in being at that time a little over a year chaired then by our distinguished friend Hon. George Miller from California.

It was at that hearing that we had appear before us Prof. Edwin J. B. Lewis of the George Washington School of Government, Business and International Affairs, and he had been asked to make a study in depth and to make his appearance before the committee on that date, June 21, 1961, to make a recommendation concerning a bill that was then pending before the committee which would, in effect, establish a National Oceanographic Council, a nonoperating agency.

In that connection the then ranking member of this committee was the distinguished gentleman from Michigan, Mr. Dingell, and I quote now from page 12 of that statement.

Mr. Dingell addressing himself to the then Professor Lewis:

That is a pretty strong statement. I happen to agree with you on it. But is it your opinion that we are in a welter of confusion in this oceanographic program of ours?

Professor LEWIS. The reading I have done on the subject has led me to that conclusion, Mr. Dingell.

Mr. DINGELL. All right. Now, let us go a step further. Is it your conclusion that the ad hoc agency set up by Executive order is going to clear up this problem?

Then speaking of the Interagency Committee—

Professor LEWIS. I would say that the ad hoc agency set up administratively has been functioning for some time, and there has been little apparent improvement in the program organization during that interval of time.

Then I was recognized and said:

Mr. Chairman, since I have been a member of this committee, since early last year, I have waited patiently for just the statement that Professor Lewis has brought out today. We have wallowed in a morass of testimony from the various agencies of the Federal Government as to what it was doing and intended to do in this field of oceanography, and all the while I sat and listened I have been wondering when someone at the management level would come here and suggest how we could put this program together.

The gentleman to my left was very charitable in his remarks, in which he stated he agreed with you, in substance, with respect to your statement as found on page 12.

I think the guts of your statement are found on page 6, beginning at line 6 and ending at line 14. I do not see how anyone who attended a majority of these hearings could fail to agree with you.

The Chairman of the Interagency Committee on Oceanography, the Assistant Secretary of the Navy, testified day before yesterday, and he indicated that even this legislation was not necessary, in his judgment. The representative of the Bureau of the Budget on the same day testified in his opinion the legislation was not necessary; that we were making all the progress that seemed to be necessary in this important field.

Of oceanography——

I think we have got to decide once and for all: Is this an important program, sufficiently so as to establish a separate and independent agency for the administration of it?

I am led to believe that it is. Perhaps others may not be.

You say—

Speaking then to the professor—

this is the minimum. You have made three suggestions. You say this is the moderate course, the minimum that we can do. And you say even the provisions of this bill, in your judgment, will not meet what you see for the future in this

program, unless it is amended along the lines that you have suggested in your statement. And I agree with that.

I am inclined to go the full way, myself, but I can perhaps see, as you have pointed out so clearly, the disadvantages certainly for the next reasonable period of time in going that far, in establishing a separate and independent agency such as we have in the National Aeronautics and Space Administration.

We got shot down by the executive branch of the Government on that bill of establishing this National Oceanographic Council which would be a nonoperating agency such as you have indicated.

So, when the distinguished Chairman left and went to chair the Committee on Astronautics and Space and the distinguished ranking member went to chair the Subcommittee on Fisheries and Wildlife Conservation, the responsibility then fell on me.

We had a series of hearings that lasted months and tried to cover everything like we are trying to cover it now, and we established the Commission and mandated them to make the study in depth, to make the recommendations based upon their individual studies, their concentrations with every facet of the marine sciences here and even abroad through their separate panels, and tell us what in their judgment we should do.

We decided at that time that we ought to also establish a national council. We there again met with obstinancies and friction and even the all-out effort to cripple us in our efforts to establish it. We did it in spite of the administration, and it is the finest thing that we ever did.

So that I find myself at this point, here in 1969, almost 8 years later. And are you satisfied with the way we are moving now in this broad program? I find myself in agreement with you in your colloquy with the gentleman from California with respect to the fact that, as to the oceanographic vessels that we built through ESSA, the Department of the Interior and some others, maybe that money ought to be spent in programs and not in capital inprovements.

I have come to the conclusion, and tried to keep an open mind about this, that we must bring together a governmental structure as recommended by this Commission, who I think are conscientious people. Perhaps even more important is the establishment of the National Advisory Council that the Commission recommended, which I think would play a very important part in bringing together and focusing upon the governmental structure, the private sector which you so clearly indicated is the one which is going to be primarily responsible for the exploitation of the oceans' resources.

Would you want to comment on my remarks?

Mr. BECKMANN. Yes. I think that when the Interagency Committee on Oceanography was formed, it was a very good idea. They have made a lot of useful suggestions through the years but unfortunately that is all they have ever been in a position to do.

Mr. LENNON. What?

Mr. BECKMANN. I say that is all they have ever been in a position to do is to make suggestions.

Mr. LENNON. They were not at a sufficient level so that they could make a policy.

Mr. BECKMANN. Well, they couldn't make a policy. More importantly, they didn't have any money, no funding of their own, or funds they could control. Therefore, they could never get anything done.

Mr. HANNA. If the Chairman will yield, I would like to make an observation as to what my experience leads me to conclude in the State of California when they moved even a step further, and instead of having an interdepartmental committee, they established a sort of a masterhouse of natural resources. It was my observation that prior to that they had disorganized chaos, and subsequent to that, they had organized chaos, and we didn't have too much output that was superior but it was a lot better organized.

Mr. LENNON. I don't know which of you gentlemen came in first, Mr. Karth or Mr. Downing. I recognize whichever one came in first. Mr. Downing.

Mr. DOWNING. Thank you, Mr. Chairman.

I am sorry that I didn't hear the gentleman's testimony. I was at another committee meeting. I read the statement and it is an excellent statement, but one with which I do not agree, and I find it a little hard to understand because you are definitely interested in oceanography.

What is Alpine doing now, Mr. Beckmann? What is it engaged in now?

Mr. BECKMANN. Manufacture of oceanographic equipment for sale to competitors, academic institutions, governments. We make marine protein concentrate which is fish protein concentrate.

Mr. DOWNING. Are you selling that commercially now?

Mr. BECKMANN. No, we are not. We work in some fish product areas, including salmon and crabs. We perform oceanographic surveys for foundation work for offshore towers, bridges, tunnels, and we do quite a bit of oceanographic surveys in connection with A.S.W. problem and application of various types of sonar.

We have five tankers and bulk carriers which we use to carry grains, coal, ammonium sulfate, and we have three leases for offshore mining rights in Cornwall, the south island in New Zealand, and in North Carolina.

Mr. DOWNING. Do I understand your statement correctly to mean that you would rather have the effort go on as it is now, mostly in the hands of private industry, rather than have the Government intervene with a Federal organization? Would that be a correct interpretation of your statement?

Mr. BECKMANN. No, I don't believe I meant to say that, if I did. I think that there should be Federal direction to oceanography, but I don't think that the way to give the Federal direction would be to make another operating agency or to bring together various pieces of different operating agencies into this group.

I would rather see it as I stated with a steering committee which defines missions, plans long-range objectives together with a nonoperating agency which provides the funding and makes up its own mind as to who gets the funds to solve the problems, whether they go to various Government agencies, they go to various universities, or they go to different industries.

Mr. HANNA. Or combinations.

Mr. BECKMANN. Or combinations thereof.

Mr. DOWNING. I respect your judgment, but I do disagree with you. Thank you very much.

Mr. LENNON. Mr. Karth.

Mr. KARTH. Mr. Chairman. I am not really sure, Mr. Chairman, that I understand what the gentleman has proposed. This is the arduous exercise I am going through at the moment.

For example, on page 3, Mr. Beckmann, you say: "We are not after developing the hardware, we—industry—seek the exploitation of the oceans."

I am not sure that you are speaking for all of the industry because I do think that, no matter what we do in this area, if we do anything meaningful at all, there obviously must be developed some system of ocean buoys, some research housing, perhaps at the bottom of the sea, and oceanographic research vessels. There is going to be any amount of hardware to be developed.

I am not sure that with the cost of that kind of hardware being what it is and having experience in another research and technological committee, that private industry is going to undertake that as a private industry investment. I am not sure that they could afford it.

You say, "Put this money into joint academic, industrial, and Government programs where the unique capabilities of each group are utilized to the maximum."

I think we all agree with that, except, that we don't spell out how it will be done or what you really mean. There is a big question mark there.

Mr. Chairman, I hope that we could have some further explanation or at least more time to study it.

Mr. LENNON. I am going to take the liberty, because I recall it so well, of finishing my comment to the witness on that date in June of 1961.

I continue:

I want to commend the gentleman, Mr. Chairman. I think he has brought us a very important policy statement, here, as to how we should proceed, and I just regret that all the members of the committee are not here to hear what he has said.

I for one hope very much that the counsel of this subcommittee and our technical adviser, here—

The distinguished Capt. Paul Bauer—

will confer at length with Professor Lewis, in the hope that this bill, as a minimum, can be amended to meet the criteria that you have established here. If we do not, I think we have just wasted time, last year and again this year.

I do not think that anything could be clearer to all of us than that if we do not at least go as far as you have recommended in the passage of this bill, we have just simply wasted the taxpayers' money in our efforts to arrive at a conclusion as to what should be done in this important field.

Then Mr. Miller came in with a very fine statement. Incidentally he complimented me, and I said:

I wish you would go further. I wish you would submit to the agencies involved, who are enumerated in the bill as possible members of this Council, the professor's statement, and tell them that in the judgment of the committee this ought to be required reading on their part.

Mr. Miller commented on the fact that most of them were sitting here that day.

Anyhow, the history of that was that we finally passed a modified version, it went over to the Senate and it finally passed over there, and it got a veto, and here we are 8 years later, and I agree with you, sir, that if we had gone on and established that, we wouldn't be here today, if the President had not vetoed that bill.

The philosophy of the administration was that the Congress was telling the administration what direction it ought to follow, and to me that is a mandate under the Constitution of the legislative body not the executive. But it was vetoed, the recommendation of all the echelon of the agencies and departments and bureaus, on the philosophy that we were trying to set the stage, and I hope we won't have that experience again this year.

I think that if that bill had been signed into law, that we wouldn't be here today. We wouldn't have to be here. I think we would have subsequently amended it and established what you have described as maybe a nonoperating government agency to take it on from there. But that is history now.

So, if you go back and read history, you see why sometimes some of us make up our minds that we just have to take a direction. We could have done worse, and I don't believe we would do worse in the future even if we follow to the letter the recommendation of the Commission's report, which I don't say that we will but hopefully we will in substance.

Are there any other questions of the gentleman?

Thank you very much, sir. We do appreciate your help and we are going to take the liberty to call on you from time to time to come back and help us with the problem.

Mr. BECKMANN. Thank you very much, sir.

Mr. LENNON. Thank you, Mr. Beckmann.

I have already identified our next witness, Dr. Sidney R. Galler, and I will ask unanimous consent that immediately preceding his statement, and you have a prepared statement, I see, Doctor, that your biographical data be incorporated in the record.

(The data referred to follow:)

BIOGRAPHICAL DATA OF SIDNEY R. GALLER

Dr. Sidney R. Galler, Assistant Secretary (Science) of the Smithsonian Institution, formerly Head of the Biology Branch of the Office of Naval Research (ONR), was born in Baltimore, Maryland, November 9, 1922. Dr. Galler is a graduate of the Baltimore City College and received his Ph. D. degree in hydrobiology from the University of Maryland. After serving as a consultant in ecology to ONR, he was appointed to the position of Head of the Biology Branch in 1950. Shortly thereafter he conceived the Navy's programs in hydrobiology and biological orientation.

Dr. Galler has been a member of many governmental, national and international committees and panels. For his role in advancing international scientific collaboration he has received letters of commendations from the Secretaries of the Navies of Mexico, Argentina, Chile, Peru and Brazil.

Among his many awards are the Navy Civilian Service Award, several outstanding performance awards and the Navy Distinguished Civilian Service Award by the Assistant Secretary of the Navy (Research and Development). This award, the highest the Department of the Navy confers on civilian employees, was given to Dr. Galler for his outstanding contributions in the fields of hydrobiology and biological orientation and for the establishment of highly effective communication between the United States Navy and the community of biological scientists in Europe and Latin America as well as in this country.

His pioneering work in bio-instrumentation led to the development of the first U.S. orbiting Biological experiment launched from Cape Kennedy on February 4, 1958. In addition, his designs in the field of bio-instrumentation led to the development of a series of radio telemetric devices which are being used to monitor the movements of birds as well as terrestrial and marine animals for scientific purposes. Dr. Galler's work in bio-instrumentation also has resulted in the construction of the first experimental underwater audio-video observatory, a remote

controlled system of underwater television cameras and acoustic devices for observing from a laboratory on land the behavior of marine organisms in the sea.

Also, he has designed a series of collecting devices which have been used to collect living material from a submarine. Among his more recent efforts to improve biological research field instrumentation, Dr. Galler conceived the idea of Research Ships of Opportunity for utilizing commercial freighters and passenger ships to carry mobile laboratory trailers for collecting oceanographic and biological measurements and samples. His two most recent inventions consist of underwater temperature controlled panels for studying the effects of elevated temperatures on both fixed and free moving marine invertebrates. These devices show considerable promise of developing into practical systems for controlling and studying organisms responsible for biological fouling and deterioration.

The author of numerous technical publications, Dr. Galler is a member of the American Society of Limnology and Oceanography, Society of Sigma Xi, Research Society of America, the Natural History Society of Maryland, the American Institute of Biological Sciences and the Cosmos Club. He is a fellow of the American Association for the Advancement of Science; The Marine Technical Society, the Maryland Academy of Sciences and the Washington Academy of Sciences.

STATEMENT OF DR. SIDNEY R. GALLER, MARINE BIOLOGIST, BALTIMORE, MD.

Dr. GALLER. Thank you, Mr. Chairman.

Mr. Chairman and members of the Subcommittee on Oceanography, my name is Sidney R. Galler, and I reside at 6232 Woodcrest Avenue in Baltimore, Md.

Mr. Chairman, I consider it a high honor to be invited to appear before this subcommittee and present my views as a private citizen on the report of the Commission for Marine Sciences, Engineering, and Resources entitled "Our Nation and the Sea." I emphasize the honor that is associated with an appearance before this subcommittee because of the historic role that it has played in the development of our national consciousness of the importance of oceanography in the United States.

The efforts of this subcommittee to direct attention to the oceans as a national resource have been most successful. Indeed, the Commission for Marine Sciences, Engineering, and Resources owes, in large measure, its existence to the leadership and dedication of this subcommittee. This subcommittee has earned the recognition and appreciation of scientists and laymen alike for developing so successfully the thesis that the oceans represent an integral and central part of man's environment.

The Commission on Marine Sciences, Engineering, and Resources, under the distinguished chairmanship of Dr. Julius A. Stratton, has prepared, after 2 years of intensive study, a report entitled "Our Nation and the Sea."

This report respresents the most comprehensive assessment of the status of marine science and technology in the United States that has ever come to my attention. The report is, in effect, a kind of master plan, or blueprint, to be followed in developing a truly national program of both ocean exploration and marine resource utilization.

I will not attempt to rephrase the many plaudits that have been bestowed upon the Commission and its report by the distinguished witnesses who have already appeared before this subcommittee. However, I seize upon this opportunity to salute Dr. Stratton and the members of the Commission for their outstanding contributions to-

ward improving our understanding of where we stand today in regard to marine science and technology as well as for their insights in delineating the technological and scientific targets for the future development of the national program.

It is the latter aspect, the one that deals with targets or objectives and the means of achieving these objectives, that is of particular interest to me and will serve as the basis for the rest of my presentation before this distinguished subcommittee. Let me be more specific. The Commission report is replete with the descriptions of objectives or opportunities as well as the scientific and technical requirements that will have to be met in order to achieve these objectives. The need for an improved technology to facilitate the development of mineral resources, the need for more scientific information to open new fisheries, the need for improved technology and more basic science to advance our capability for environmental monitoring and prediction are all examples of the variety of requirements and goals that are so well presented in the report.

At the same time, however, I recognize the need for a more comprehensive treatment of the requirements and goals in those fundamental sciences that provide the corpus of basic knowledge for advancing oceanography and marine technology. I am particularly concerned with the need to identify clearly the requirement for basic biological information that serves as a foundation for the development of programmatic marine science and technology.

I wonder how many of us are aware of the fact that our success in developing new fisheries as well as aquaculture will depend, to a great extent, on our ability to support a balanced program of taxonomic research.

Basic information derived from the identification and classification of marine organisms constitutes an essential requisite for understanding the behavior as well as the geographic and seasonal distribution of marine and animals and plants of importance to man. Yet, ironically, the information gap between taxonomy and the programmatic marine sciences is widening in inverse proportion to the increase in support of oceanography and the related marine sciences. The incongruity can be understood only if one measures available resources in taxonomy against the growing demand for taxonomic information. The increase in oceanographic activity within the last decade, including the increase in the number of collections of marine organisms made from oceanographic ships, has resulted in a tremendous and still growing backlog of specimens waiting to be identified and classified.

At the same time, our national resources for taxonomy have not increased to any appreciable extent. Today the front line of taxonomists is a thin one indeed. Even within the Smithsonian Institution, with its relatively large concentration of competent taxonomic scientists as well as with its Oceanographic Sorting Center, it is not possible to keep up with the demand for taxonomic information. As a consequence, our country is unable to derive full benefits from the very substantial investment of dollars and manpower in the acquisition of collections and oceanographic data.

Indeed, the world situation with regard to taxonomy is not an encouraging one. Until such time as we recognize taxonomy's essential role and provide the necessary resources commensurate with its high

priority, we will find it ever more difficult to achieve some of our important objectives in marine science and technology.

With regard to taxonomy and in relation to the Commission's laudable recommendation for the establishment of national laboratories, I am of the opinion that there already exists a unique national laboratory, namely the Smithsonian Institution. Increased support for the urgently needed training of additional taxonomists as well as for taxonomical research, both in the Smithsonian Institution and in universities around the country, is the only reasonable solution to a most serious but little understood problem.

The Commission report also addresses itself to the requirement for improved technology and more research in order to achieve an improved capability for environmental monitoring and prediction. Certainly, I can give this recommendation my enthusiastic support. At the same time, however, the report barely touches on a collateral objective in marine sciences which should receive our most earnest consideration—namely, the need to develop a capability for ecological prediction and assessment.

Man's rapidly increasing capability of manipulating his environment is not limited to the 25 percent of the earth's surface which we call land. His capability extends into the oceans as well as into the atmosphere around us. Statistically the chances of producing irreversible and deleterious environmental changes are increasing significantly. We dare not continue to regard with complacency the construction of such monumental projects as an Aswan Dam or a plan for an interoceanic sea level canal without first predicting and assessing the ecological risks involved. I regret to have to inform this subcommittee that our present capability for predicting the ecological consequences of man's manipulation of his estuarine and oceanic environment is vanishingly small. Here, too, we have a rapidly widening gap between need and capability. Oil spills, thermal pollution, chemical and domestic contamination, and land filling are but a few of the man-produced insults to estuarine and coastal environments. If, in addition, we divert the flow of rivers leading into estuaries, and indeed, change the pattern of coastal currents, we can anticipate major and possibly catastrophic changes in the ecology of many of our coastal zones.

I cannot overstress the importance of developing a national capability for ecological prediction and assessment. We must be prepared to make substantial investments in the education and training of marine ecologists and related biological specialists. We must be prepared to make the investment in the very near future if we are to have any reasonable expectation of closing the gap between need and capability.

In concluding this statement, Mr. Chairman and gentlemen of the subcommittee, I wish to emphasize once again my support of the Commission's report, especially the principles and guidelines which are so clearly presented. What we need now, in my opinion, is a matching inventory and assessment of the goals and needs both in terms of manpower, as well as money and facilities of the basic scientific disciplines that undergird and support marine science and technology. We must be especially diligent in identifying those fields of scientific endeavor, that although not usually recognized as an integral part of marine science and technology, nevertheless contribute in an essential way to

the intellectual nourishment of the programmatic marine sciences. This is especially true of such basic biological disciplines as taxonomy, ecology, bacteriology, paleobiology, as well as invertebrate and vertebrate physiology to name a few. These fields or disciplines should be considered as the underpinnings of oceanography and marine technology, and should be strengthened accordingly.

Mr. Chairman and members of the subcommittee, I have appreciated the opportunity of coming before you today, and I wish to assure you of my continued admiration and support of your leadership in the development of our national program of marine sciences and technology. Thank you.

Mr. LENNON. Thank you very much, Doctor.

Mr. Schadeberg.

Mr. SCHADEBERG. Mr. Chairman, I have to admit that I have to learn an awful lot. I think there is a saying in literature some place that, "He who knows not, and knows not that he knows not, is a fool . . . He who knows not, and knows that he knows not, is simple." I am some place in the middle of that.

I appreciate this opportunity to have men like the doctor here to inform us.

Doctor, in page 6 you made some statement with regard to the Panama Canal and the Aswan Dam.

Dr. GALLER. Yes, sir.

Mr. SCHADEBERG. Could you enlighten me at least as to the possible damages that might result from construction of the dam or construction of the sea level canal?

Dr. GALLER. With regard to the proposed interoceanic sea level canal, Mr. Congressman, there is a controversy that is heating up between those who feel that we do not have to worry about possible deleterious effects and those who feel that indeed there is a possibility of having some very serious and possibly irreversible changes occur as a result of cutting through and connecting two oceans that have been separated according to estimates by geologists for a period of between 6 and 9 millions of years. In that period of time there may have developed separate but related species of marine organisms, both plants and animals.

One of the questions that arises, for which we don't have the answer, is what happens when you simply cut through a land bridge and permit organisms that have been separated to come together and mix. Are they going to produce hybrids that may in turn wipe out populations of endemic forms that have had some commercial importance? Are they going to become predators on other organisms? Will this permit organisms that we know to be deadly to man to transverse the canal and go from the Pacific into the Caribbean and possibly be carried by the Gulf Stream up the coast of North America?

We don't know. I submit that the acquisition of these kinds of data and capability of assessment is of paramount importance before we decide to go ahead tampering with the environment. In the case of the Aswan Dam, it has been demonstrated even at this early stage that the damming of the River Nile seriously reduces the volume of fresh water and its burden of dissolved organic nutrients that flows into the eastern Mediterranean.

It has been suggested that this in turn may produce warming of the waters, depleted oxygen, reduced circulation, inadequate nourishment for the organisms, and eventual elimination of important coastal fisheries.

I do not say that all the changes that may be wrought will be deleterious. In fact, I am not even sure that there will be any substantial ecological change. I am suggesting, however, that we cannot afford to run the risk of producing irreversible changes without first knowing what those changes might be and determining whether we are willing to put up with them.

Mr. SCHADEBERG. Doctor, that is a very fine statement.

Would the same possibility of deleterious effects in the area of the Aswan Dam apply to dams that we might build in this country?

Dr. GALLER. Yes, sir. I think that to some extent that is also true for dams that we have built in this country and plan to build in this country.

Mr. SCHADEBERG. I remember the testimony the other day that we had in the hearing where one of the witnesses said that we didn't know it but if we had a sea level canal it might make a difference in the changes of the temperature of the water in the oceans which might affect the world weather. I think this has caused us some real second thoughts, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Schadeberg.

Mr. Karth.

Mr. KARTH. Thank you, Mr. Chairman.

I appreciate Dr. Galler's obvious interest in ecology and the total environment, Mr. Chairman, because unfortunately there are not enough people who are really interested in it, perhaps because there are not enough people who really understand its serious consequences.

We continue to pollute the atmosphere of the earth and the oceans but I do want to assure Dr. Galler that there is great interest today in this whole question in Congress; more than ever before. I am on another subcommittee of this full committee, Fisheries and Wildlife Conservation, and we are now holding hearings on a bill, which would establish a 3-man advisory commission to the President on this very question and study not only the pollutants that are going into the sea but also the pollutants that are going into the air and the land; study the whole ecological question. The feeling that you must relate to the atmosphere and the earth and seas all at one time, and cannot just study these things as separate parts is understood. So we do want to assure the Doctor that it is getting some attention.

Mr. LENNON. Thank you, Mr. Karth.

Mr. Ruppe.

Mr. RUPPE. Thank you, Mr. Chairman.

I note that on the bottom of page 3 and the top of page 4 you say that—

> The information gap between taxonomy and the programmatic marine sciences is widening in inverse proportion to the increase in support of oceanography and the related marine sciences.

I wonder if you would expand on that a little, if you would.

Dr. GALLER. I will try, Mr. Congressman.

Taxonomy is essentially the science of identification and classification of the organisms of the earth according to their natural relationships. If I may interject a moment of levity, it has been described as an extension of Noah's work. Taxonomy or systematics is the ordering or the natural classification of minerals and the species of plants and animals under man's dominion. It is the basis for studying natural selection and the mechanisms for explaining the distribution of plants and animals, both geographically, seasonally, and in the case of the oceans the vertical distribution as well. It gives us the background that we need for studying evolutionary biology, how organisms have undergone a series of changes up to the present, and provides clues of both geological and economic significance. For example, the taxonomy of foraminifera, very small, shelled protozoans that are found in bottom deposits in the oceans, often provides geophysical exploration organizations with geological clues as to the location of oil deposits in certain areas. Taxonomy is of direct economic importance but at the same time of basic importance to some of our more "modern" sciences.

We have not yet discovered how to examine, how to study and identify and classify animals and plants by machines alone. It takes a scientist with many years of training and experience to examine organisms and by means of an elaborate classification system developed over a period of hundreds of years derive new knowledge about the biology of the organism, its distribution and how it evolved. This is the basis for ecology which attempts to study the interrelationships of organisms and the environment and of course it is one of the mainstays of modern oceanography, the distribution and ecology of marine organisms in the oceans. By virtue of the fact that it takes trained men, and an almost exclusively human endeavor to produce these classifications and identifications, we must have many more taxonomists to handle the rapidly increasing number of specimens and the associated environmental data that is being collected from oceanographic ships and through other means.

Without an improved opportunity of feeding back the information that is derived from taxonomic studies of marine organisms we will continue to maintain an attenuated feedback system where there is a lot going in and a relatively small amount of data coming out. Until such time as we improve our support of taxonomy there will remain the problem of the backlog. We may end up as we have with the collections from the Challenger Expedition of 1872 some of which are still sitting on shelves waiting to be identified. Today we can't afford to wait that long if we want to obtain the oceanographic information that we need to advance our national program.

Mr. RUPPE. The science of taxonomy, then, identifies and classifies but it does at the same time give an indication of the location and movement and depth?

Dr. GALLER. Yes, sir; and the biology of the organism, information about its life cycle.

Mr. RUPPE. Is that achieved through actual field study, or is it achieved as I say, through cumulation of data, more or less a fallback?

Dr. GALLER. It is achieved both ways, Mr. Congressman. The scientists engaged in toxonomic research frequently do go into the field and

collect and make field observations. Later they bring their collections back to the laboratory where they are carefully sorted out and separated into component collections. Then, taxonomic specialists, perhaps a man who is a specialists in crustacea, another who may be concerned with mollusks, specialists concerned with the classification study those components or fractions of the collections that are of special interest to them.

There is a tremendous amount of information in these three-dimensional data and that is what organisms are. They are three-dimensional concentrates of data and we have to improve our means for extracting that data and putting it to work.

Mr. RUPPE. Thank you very much.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Ruppe.

Doctor, are you suggesting that there is a shortage of those in your field to make these studies?

Dr. GALLER. Yes, sir.

Mr. LENNON. We are not training enough, there is not enough interest generated, enough financial attraction to have people enter your field in sufficient numbers to provide the number of people we need in the area that you are talking about?

Dr. GALLER. Exactly so, Mr. Chairman.

Mr. LENNON. I was interested, I think, just a couple of days ago in some poll that was taken I believe in Princeton University giving a percentage of the students who indicated what they hoped to be doing or expected to be doing 20 years from now.

I think 2 percent expected to be in medicine while 29 percent expected to be teaching, and it was spread out from there. But only 2 percent of our people at this university indicated any desire or hope that they would be in the field of medicine.

Dr. GALLER. Mr. Chairman, the field of taxonomy up to the present cannot compete financially with many other areas of science and technology.

Mr. LENNON. That is the point I was making. I thought from the stories I had read about medicare and medicaid, with two brothers getting some $380,000 in some 12-month period it seemed that the most lucrative thing a man could do was to get into medicine, but only 2 percent wanted to do so in this survey.

Dr. GALLER. I wanted to conclude by saying that we have to find ways of attracting bright young men and women into the field of taxonomy. It is a very exciting area of science but it is an undersupported one.

It is very difficult for a taxonomist to "retail" his science if I may use the vernacular. He is really a producer and "wholesaler" of fundamental scientific information, that is then picked up in other disciplines and incorporated, serving as the base for their own advances. The glamour comes through oceanography but the inputs are derived at least in the biological end of oceanography from some of the classic fields of science, especially taxonomy.

Mr. LENNON. Counsel?

Mr. DREWRY. Dr. Galler, on your ecological studies, wouldn't it be fair to say that a real good simple example of the problems is that represented by the sea lamprey invasion of the Great Lakes and the ultimate killing off of the trout population in Lake Michigan?

Dr. GALLER. Sir, I think that would be a classic example. It is an example of what I call "pathological" ecology where we try to treat an ecological disease that might have been prevented. Indeed, in this particular case, in 1937 a distinguished scientist, Dr. Carl Hubbs, pointed out the dangers of cutting through the Weyland Canal and pointed specifically to the dangers of permitting the sea lamprey to enter the Great Lakes. His advice was not followed and so we have inherited a whole series of consequences. We started with the sea lamprey that wiped out the trout fishery, the white fish industry. Then after the sea lamprey was controlled came the alewives. Without natural predators they in turn proliferated to the point where they constituted a very serious public health menace.

Now we have introduced salmon to control the menhaden. Let's hope it works, but this is what I call ecological empiricism in which we are operating by the seat of our trousers if I may speak candidly. What we need is an ecological model, a means of helping industry, helping the States, and helping the Federal agencies to predict and assess what could happen if they go forward with specific plans that involve manipulating the environment.

Mr. DREWRY. Incidentally, it has been extremely expensive since the sea lamprey came, aside from the fact that the fishery was wiped out.

On this taxonomic question, how extensive is the education and training of a competent taxonomist?

Dr. GALLER. It is quite extensive, Mr. Drewry. However, it is limited and I am afraid becoming more limited to a relatively small number of universities and the Smithsonian Institution. The Institution with its own limited resources works closely with scientists in universities to help with the training of graduate students, but we can not as a Nation right now count on very much help from the academic institutions because there just aren't very many institutions engaged in the training of taxonomic scientists.

Mr. DREWRY. Well, as I say, it is fundamental science. The taxonomist makes what kind of compensation? What kind of pay would a competent taxonomist get at the Smithsonian?

Dr. GALLER. I would say that the taxonomist within the Smithsonian Institution does have a reasonable parity of salary with his confreres in the other sciences in the Federal service. Where he is at a disadvantage is that he finds it very difficult to convince his peers, both in the executive branch and in the legislative branch and the granting agencies, that his science merits sufficient financial support to permit him to go forward with his research.

So, we are in the position as in the case of the Smithsonian Institution and also the USDA and the Department of the Interior employ small groups of taxonomists, providing adequate salaries, but not enough support for research.

Mr. DREWRY. In other words, the problem is not so much with the salary but rather inadequacy of funds for the overhead, shall we say, or the materials or the laboratory space or whatever?

Dr. GALLER. Correct. This is peculiarly true of the Federal or quasi-Federal agencies. In the university hierarchy we find that there does not exist any real salary parity between most taxonomists and their colleagues in some of the other better known, more glamorous fields of scientific endeavor, and as a consequence, young people are not encouraged to move into taxonomy as a lifetime career.

Mr. DREWRY. Is this an area where the sea-grant college program could be helpful in stimulating interest?

Dr. GALLER. It could, indeed. It could make a tremendous contribution, Mr. Drewry.

Mr. DREWRY. Does industry use taxonomists in any extent? I remember I was recently down at Houston and saw a remarkable machine for analyzing fossils. I would assume that the oil industry must be concerned about this type of thing, and I would assume that probably ESSO Production Research Corp. would probably have some taxonomists on hand.

Dr. GALLER. They have, indeed, I would say. My guess is that our petroleum and geophysical exploration industry represents the largest industrial user of taxonomists. But they employ taxonomists that are already trained and experienced and have usually come up through the academic ladder.

I don't believe that they make substantial investments in the education and training of taxonomists.

Mr. DREWRY. That was my next question. Should industry be encouraged and can industry be encouraged to speak out for and provide greater support for an incentive for a young man to go into this field?

Dr. GALLER. I think there is that possibility, Mr. Drewry, provided that industry is encouraged to recognize that it has divested interest in taxonomists and taxonomic information.

For example, the Commission report invites special attention to the potential of drugs from the sea, the pharmacologically active substances that are derivable from a variety of marine organisms. Here is where taxonomy must play a key role in identifying and classifying important organisms and informing other kinds of scientists, such as pharmacologists about the life cycle and the ecology as clues to the potential value of an animal or plant as antibiotic sources.

Our recreational industry has to be encouraged to recognize that they depend heavily on taxonomic information both to identify economically important sports fishes as well as to identify potentially dangerous fishes like sharks. Until recently we had a National Shark Research Panel that provided our country with much taxonomic information about sharks. However, it has faded out because of lack of support.

Mr. DREWRY. Thank you very much, Dr. Galler, and thank you, Mr. Chairman.

Mr. LENNON. Thank you very much, Dr. Galler.

We will feel free to call on you for advice and counsel and assistance to determine the course we will take in the future.

Dr. GALLER. Thank you very much.

Mr. LENNON. Let me take this minute to announce that the hearings will be continued tomorrow, and we will have the pleasure of having Mr. Roger J. Pierce, of the Hydro-Space Systems Corp.

We will have Mr. Robert M. Clark, vice president of Hayden, Stone, Inc.

We will go off the record.

(Discussion off the record.)

Mr. LENNON. While I am here we also will announce the Tuesday schedule: Dr. William Hargis, director of the Virginia Institute of Marine Sciences; and Dr. Bruce Halstead, director of The World Life Research Institute.

With that, we will conclude the hearings for the day until tomorrow morning at 10.

Thank you for your presence.

(Whereupon, at 12 noon the subcommittee recessed, to reconvene at 10 a.m., Wednesday, May 28, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

WEDNESDAY, MAY 28, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:10 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Alton Lennon (chairman of the subcommittee) presiding.

Mr. LENNON. Gentlemen, the meeting will come to order.

The witness today whose name and identification were mentioned yesterday is Mr. Roger J. Pierce of the Hydro-Space Systems Corp., and he is accompanied by the distinguished Representative from Iowa, Mr. John C. Culver, who will present him at this time.

STATEMENT OF HON. JOHN C. CULVER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF IOWA

Mr. CULVER. Thank you very much, Mr. Chairman, and distinguished members of the subcommittee.

It is a pleasure for me to be able to introduce to you this morning Mr. Roger J. Pierce, the president of Hydro-Space Systems Corp. of Cedar Rapids, Iowa.

Mr. Pierce founded Hydro-Space in 1964, after more than 30 years' experience in engineering and advanced electronic systems.

He came to Hydro-Space, having played a leading role at Collins Radio Co. in Cedar Rapids in the development of sophisticated communications equipment and systems which have made possible the radio and television transmissions which have impressed all of us in the Apollo space efforts.

He has been one of the earliest and most articulate exponents of a national effort to exploit ocean and marine resources, similar to the commitment which was made to the exploration of outer space with such successful results.

During the first 5 years of its operation, Hydro-Space has made pioneering contributions to the vast and still largely untapped field of oceanography.

As president and architect of that company, Mr. Pierce is well qualified to address this subcommittee on the formation and funding of a National Ocean and Atmospheric Agency, and I am pleased to introduce him to you.

(The biographical sketch of Mr. Pierce follows:)

BIOGRAPHICAL SKETCH OF ROGER J. PIERCE

Mr. Pierce is a businessman/scientist and is President and founder of Hydro-Space Systems Corporation, Cedar Rapids, Iowa. This company is four years old, and its main thrust is in the field of advanced projects in oceanography. He is a veteran with 35 years' experience as an engineer and administrator in advanced electronics systems for the commercial, military and space programs.

His past assignments have been with Collins Radio Company, Harvard University and Motorola, Inc. until he founded Hydro-Space in 1964. He is an inventor and holds several U.S. patents related to electronics, missile systems, and oceanographic vehicles. He is also an author of several technical articles in his field which have been published nationally.

He is a charter member of The Marine Technology Society, member of The American Association for Advancement of Science and of the honorary scientific fraternity Sigma Xi and a Fellow of the Institute of Electrical and Electronics Engineers.

Mr. LENNON. Thank you, Mr. Culver.

We are delighted to have Mr. Pierce.

Mr. Pierce, I see you have a prepared statement.

Do we have the résumé of Mr. Pierce's biographical information?

STATEMENT OF ROGER J. PIERCE, PRESIDENT, HYDROSPACE SYSTEMS CORP., CEDAR RAPIDS, IOWA

Mr. PIERCE. The résumé is in the back of the statement, Mr. Chairman.

Mr. LENNON. We have a wonderful one given by your distinguished representative, Mr. Culver. I am sure that will suffice.

You may proceed, Mr. Pierce.

Mr. PIERCE. I should like to thank this committee for giving me the opportunity to come here and giving you my views on the formation of a National Ocean and Atmospheric Agency to lead the national effort.

In general, I support the recommendations of the Marine Science, Engineering, and Resources Commission for the formation and funding of a National Ocean and Atmospheric Agency as the best plan for national action to start substantive exploitation of the oceans.

However, I differ somewhat from the Commission recommendations in two areas related to staffing of this agency and to the programs suggested. These are matters upon which I will discuss later on.

Before doing so, I would like to express myself on some of the socioeconomic-technological implications of the establishment of a Central Government agency such as NOAA to lead the national effort in the ocean challenge.

PRIVATE ENTERPRISE VIS-A-VIS GOVERNMENT CONTROL

Some fears have been expressed by a few groups in private enterprise and the scientific community that a Central Government agency directing, sponsoring, and funding the ocean effort would be unduly restrictive and inhibiting in the full free exercise of the prerogatives of private enterprise in expanding the ocean effort.

As one representative of private enterprise, I do not agree with this position and feel that a NOAA would ultimately result in a greater

freedom and capability by private enterprise to engage in ocean projects on their own initiative.

My reason for saying this is that I believe that initial expenditure of money to develop the basic ocean technology required for substantive accomplishments in the sea is far beyond the means of even the largest of private business organizations.

I believe the effort should be a partnership between Government and industry together to do a big job without serious limitations in manpower and money to get the job done. The partners' roles in this effort is clearly defined. The Government to formulate, direct, and supply the billions of dollars required and industry to spend these dollars to implement the programs.

I feel that once the basic technology is developed by Government expenditure, that private industry can reproduce this hardware and carry out ocean operations on an economical basis for commercial use entirely on their own without future Government support.

A good example of this type of evolution from Government sponsorship to sponsorship by private enterprise is our commercial jet airliners. The Government originally spent billions of dollars developing their military jet predecessors. Private enterprise then took this technology and experience and produced commercial jet airliners which could be manufactured and sold at a profit without further sudsidy from the Government. So it can be with ocean hardware.

PARITY IN PRESENT TALENT AND TECHNOLOGY FOR EASY TRANSFER TO THE OCEAN EFFORT

I believe that the sector of American industry that has been associated with the advanced military and space program already has the technology and much of the physical plant facility to redirect to the ocean effort without retraining in oceanography.

The same talent, the same scientific disciplines, most of the same plant and equipment apply to oceanography as apply to aerospace and advanced weaponry. The only difference is that the medium of operations is water rather than land or air. In short, we presently have the national scientific and physical resources to use in this area, and it is not necessary to develop a new breed of scientists, engineers. and techniques to carry out this effort. We already have them and they could be reconverted almost overnight to new jobs related to the oceans.

PUBLIC ACCEPTANCE

I believe the U.S. public will accept the formation and expenditure of a NOAA as meaningful and publicly acceptable usage of our surplus scientific resources to useful and valuable effort in the national interest. As we train more and more scientists and engineers, it will be an economic necessity to find useful employment and outlet for the talents of the expanding scientific community which cannot be totally absorbed in the commercial sector.

What better usage for this talent could there be than one which not only helps solve an economic problem but has such great potential in economic returns as exploitation of the oceans?

I tend to feel the public will accept this with as much enthusiasm as the national space effort—perhaps with even more enthusiasm, since it is not hard for even the layman to see the possibilities of almost immediate economic returns from exploitation of the oceans.

STAFFING BY SHIFTING OTHER GOVERNMENT AGENCIES INTO NOAA

In general, I support the recommendatioss of the Commission in staffing the agency by shifting other related Government agencies into the new organization.

However, I would suggest that, first, the Congress authorize and establish NOAA with at least the level of funding now being spent by the Government in oceanography.

This agency would then be charged by Congress to first review the recommendations of the Commission and suggest modifications they feel make a better national program.

Once a sound program has been established and authorized by the Congress, the matter of staffing would be a proper consideration. After this is thoroughly considered by the Administrator and his staff, NOAA could then recommend to the Congress which Government agencies or segments of such agencies would best fit their plans to carry out the program planned.

The Congress could then act on the recommendations of the NOAA as they see fit.

I feel that this would be a better plan than the immediate shift of the specific Government agencies recommended by the Commission. It would give the NOAA Administrator a voice on the composition of the various task groups to carry out the program for which he has the ultimate responsibility.

DEVELOPMENT OF BASIC OCEAN COMPONENTS FIRST

I differ somewhat from the report of the Commission in that I believe a large amount of the initial program should be directed at developing the basic components for man's occupancy and exploitation of the sea. In short, develop the tools before you try to do the job.

The main components which need intensive and massive research and development are:

(*a*) Stable sea structures, or sea buildings.
(*b*) High-speed surface and subsurface transportation.
(*c*) Ocean robots.
(*d*) Communications.
(*e*) Primary power sources.

While the programs suggested by the Commission are excellent and do to some extent recommend development of deep submersibles and nuclear power, I believe the scope suggested could be expanded.

I believe that a wide range of these basic components mentioned above should be developed first. If this were done, I believe that some of the programs they suggest and others that will come up in the future could be accomplished more efficiently and faster.

These basic components or "tools" would eventually enable man to work in the sea with almost as much facility as he now does on land.

At this point, I would like to expand briefly on these components by showing you some charts of imaginative drawings of these items.

If I may have the lights out, I would like to project the slides on the wall. I regret that I do not have a screen.

Mr. DOWNING. I think we can see them all right.

[Slide presentation.]

Mr. PIERCE. [Slide.] This is a recap of the basic components I mentioned, of sea buildings, sea structures, fast surface and subsurface transportation, ocean robots or ocean work horses, communications, and primary power services.

Now, these items here are comparable to the things that we have on land today and consider commonplace. For example, buildings. There is an infinite variety of buildings that we use in all areas of land activity.

In transportation, we have again a wide spectrum from automobiles, to buses, planes, trains, and so on.

In workhorses, we have the cranes, the bulldozers and all the heavy construction machinery necessary to industry today.

In communications, it goes without saying that on land we are tied together by wire communications, voice communications, messages of record, television, and so on.

On primary power, we have power packages from the tiniest batteries on up to nuclear reactors on land.

So, you can see that these components have been developed to a very high degree of sophistication and we can do all the things you see today in our very advanced technological society.

Now we are just at the threshold of ocean development. If we expect to do substantive work and have man occupy the oceans, we will have to make a start on these basic components.

I am sure it will be many years before we will have all the facilities in the oceans that we do on land but this is, in my opinion, where you start, to develop the basic tools first and then go ahead with the specific programs and expand them into the complexity which I am sure we will eventually see in the next 10 years.

If we address ourselves to the effort of developing these basic components, the other things that the Commission suggests will become a reality perhaps a lot sooner than we think.

Mr. PIERCE. [Slide.] This is an imaginative concept of an ocean building. In an ocean structure, the main consideration is in having a stable structure that is decoupled from the surface environment where winds of 100 knots and 50-foot waves, do not greatly affect the stability of the structure so that man can work with relative ease in this kind of environment, and where he is not pitching or heaving as you do on surface platforms.

Also, it is possible to hold the station or the building in position by dynamic electronic station keeping without the use of anchors.

This particular structure would be submerged a considerable distance below the surface where the water is quiet and the exposure at the surface would be rather minimal, offering a possibility for a very stable structure.

Now, these would be very complicated, very expensive, and would be somewhat analogous to a space ship in the ocean. These can be scaled

up and down from very small ones to very large ones to fit a wide variety of purposes for whatever you want to do in the oceans, whether to produce oil from offshore, factories, food processing or just plain office buildings or recreational hotels.

Mr. PIERCE. [Slide.] This slide gives you some imaginative, rather speculative dimensions of such sea buildings which are technologically possible today, this sketch shows a building 300 feet down, 1,000 feet in diameter, disus shaped with a high density stabilizing mass at the bottom and 100,000 square feet area in the low-density chamber.

As I say, this is purely speculative and gives you some ideas of what might be done.

Mr. PIERCE. [Slide.] Now, another component is that of transportation. Here we will have to go to new concepts and new techniques in getting very fast transportation above the surface of the ocean and below the surface of the ocean. Present surface ships and hydro foils are too slow. What we need is a generation of surface effects craft that cruise above the surface of the waves on a cushion of air at speeds possibly from 100 to 150 knots. These could be in very large sizes from thousands of tons down to very small sizes for personal transportation.

I believe considerable work has already been started on this and that the Maritime Administration has a study program on a large vehicle of this kind for transoceanic freighting and passenger service.

Now, in the subsurface realm, we have already made a start in small submersibles. Here again I think you need a fairly wide spectrum of components for transportation such as a small two-passenger "submobiles," possibly "bus" type submarines and on up to the very large passenger and freight-type submersibles that will cruise at considerably greater speed than the present by technological advancement in reducing the drag coefficient which reduces the power required to make these vehicles go at 100 knots below the surface of the sea. Much work needs to be done in this area.

Mr. PIERCE. [Slide.] The other area I mentioned is ocean robots or work horses. In working in the sea it is necessary that we be able to work with facility from the surface all the way down into the ocean depths. The "Man in the Sea" program for the shallow coastal areas has a useful application but as we advance into the oceans it will be necessary to go way down and be in an environment that is very difficult for a human to withstand. So, they must be enclosed in an almost normal environment similar to the submarine but with facility to do very delicate manipulations, to pick up things or to do heavy work such as the imaginative bulldozer shown here.

This is technologically possible with the work that has been done in "man machines" where the motions of a man's hand can be transmitted to external steel muscles and fingers to exert great power with great delicacy.

Here again I think we will need a wide variety of this type of thing to really work in the oceans.

Mr. PIERCE. [Slide.] I mentioned communications. At present, above the surface of the ocean it is relatively easy with present technology to communicate with vehicles traversing the skies and relaying via a synchronous satellite to shore. However, with all the fixed and moving vehicles in the ocean we will need an intergrated system of surface elecromagnetic radiation equipment and sonic underwater communi-

cation equipment so that a submarine, for example, could talk to the home office by some communication to a sea station which has equipment to relay electromagnetically to a synchronous satellite on to shore. Then there would be an integrated continuity of communications with all this activity in the sea, on the sea, in the air and on shore.

If we envision a very busy ocean with many, many structures, vehicles, communications of all kinds; voice communications, messages of record, and television will be very important to tie all this activity together. [Slide.]

The last is the component of power. Here again with all the various types of activity that can be envisioned; surface and subsurface platforms, bottom installations, and submersibles, it will be necessary to develop seagoing power supplies from very small power packages to middle-sized ones on up to megawatt nuclear reactors such as that suggested in the Commission's report, for all these important components of ocean exploration.

So, in general, it is my feeling while these drawings are imaginative and I would not attempt to support the designs technologically at this time, they serve to give you some idea of the amount of work we will have to do in these areas to make a beginning that eventually will enable us to work in the sea with nearly the same facility that we do on land.

In conclusion, as a scientist and engineer with many years' experience in the Government/industrial partnership for the military and space sectors, I feel that we in the field of technology can do about anything we can conceive and set our minds to do in the oceans, provided we are properly supported by Government direction and money.

I would strongly recommend this committee of Congress act to approve and recommend funding the National Oceanographic and Atmospheric Agency as soon as possible, and make the remainder of the 20th century a significant one in terms of the challenge of the "wet frontier".

Thank you.

Mr. LENNON. Thank you very much, Mr. Pierce.

I will ask unanimous consent that immediately following the splendid introduction by our colleague and friend, Congressman Culver, of our witness today that there be inserted in the record following the presentation the biographical sketch of Mr. Roger J. Pierce.

Now, Mr. Mosher.

Mr. MOSHER. Mr. Chairman, I have no questions.

I think it is very good to have this strong testimony in support of the program. It is a very stimulating and imaginative statement, esepcially the illustrations.

I think it is good to have this from the private sector particularly from land-locked Cedar Rapids, Iowa.

Mr. LENNON. Thank you, sir.

Mr. Downing of Virginia.

Mr. DOWNING. Thank you, Mr. Chairman.

I, too, think it was most interesting and informative. I just have one question.

What do you envision as the purposes of an underwater building?

Mr. PIERCE. I would at present envision it as a possible factory or facility, say, for underwater operations, for offshore oil, for example,

also food processing or in the areas of mining, of bringing up nodules from the bottom of the ocean where it could serve as a base for operations and storage until they can be transferred to a surface craft to bring them to shore where they could be processed.

In short, as a stable operating base out where the raw materials are located rather than trying to use a surface platform or a vessel which is exposed to the very severe ocean environment of pitching and rolling which is not conducive to the efficient operations. Particularly in very severe weather where operations might have to be suspended and crews go to shore which would be very uneconomical.

Mr. DOWNING. Thank you very much.

Thank you, Mr. Chairman.

Mr. LENNON. Mr. Pelly.

Mr. PELLY. In looking through your biographical sketch, I do not find that you are descended from Jules Verne but I think it could well be the case.

I don't think there is anything unrealistic or impractical about some of these imaginative uses of the ocean. I, myself, feel that eventually we are going to have fish farms and seafood product farms under the sea and other means of providing the protein that will be needed to feed the population of the world.

So, while we might have large community centers such as the structures you suggest, perhaps smaller individual habitations for humans to conduct necessary aquacultural operations, would seem very practical to me.

Mr. PIERCE. May I say, Congressman, that while part of it is imaginative, quite a bit of it is due to my experience in the space field where in 1958 I saw the first Sputnik go across the sky and some 12 short years later, as we see all the tremendously wonderful things that have been accomplished in space from the recent trip to the moon and all the various unmanned sophisticated satellites that are in the sky today, at that time I would not have dared predict the amount and complexity of the present accomplishments in the space field.

I am sure with this same type of technology and the same type of imaginative thinking we can do these imaginative things in the oceans too. In 10 years, if we go about it properly we may be quite surprised at what we can do in the oceans, possibly along some of the lines I have talked about here.

Mr. PELLY. It is hard for me to conceive of utilizing the Moon or Mars as a means of providing food for mankind. I can see so many better opportunities here at home. Really, we are going far afield too fast and too soon relative to the way that we have conducted our own exploration here on this particular planet.

I want to thank you for your contribution here.

I certainly think that the farmers of Iowa might well be interested in oceanography as opposed to outer space because they can see some of the beautiful pigs that we have heard about actually grunting and running around under the sea some day.

Mr. LENNON. The gentleman from Minnesota, Mr. Karth.

Mr. KARTH. Thank you, Mr. Chairman.

Mr. Chairman, I want to congratulate Mr. Pierce for having brought to us one of those rare presentations where on the one hand it is specific and on the other hand it is also imaginative and evolutionary.

We don't get too many papers of this kind, Mr. Pierce.

Let me just say, Mr. Chairman, in addition to that, that I was most interested in his proposal on page 4 where he proposes or suggests a means of setting up the new organization or the new agency, NOAA.

I think, Mr. Chairman, it has given us a new dimension to consider in setting up the agency because he has delineated a plan that may well be less difficult for us to accomplish in the initial legislation by proposing that we set up NOAA first without attaching to it immediately, all of the components of the various agencies that are today working in the field of oceanography.

It may well be, Mr. Pierce, that this is the most expeditious, although it appears to be a bits and pieces suggestion; it might be the most expeditious one for us to follow. At any rate, I think it is certainly worth our looking at and considering.

I want to thank you very much for bringing to our attention this new possibility.

Mr. Pierce, it is not also true that in addition to those commercial possibilities you see for work under the sea that one of the first things we will probably have to do is to establish rather sophisticated undersea laboratories to do the basic and applied research that must be done properly, prior to the time that we can in fact extract some of the mineral wealth, prior to the time that we can in fact extract some of the food wealth we know exists in great quantities in the ocean?

So, I would assume that you are also thinking about rather complex and sophisticated research laboratories in the initial phases of oceanographic research.

Mr. Pierce. Yes; I think that is also a very necessary component.

Mr. Karth. Thank you, Mr. Chairman.

Mr. Lennon. Thank you.

The gentleman from New York, Mr. Biaggi.

Mr. Biaggi. Thank you, Mr. Pierce, for your presentation.

On page 3, you say that the public will accept this program with as much enthusiasm as the national space effort. I think in view of the development economically and the progress we have made in the space effort, that is a question that remains to be answered.

I have several other questions.

You mentioned something about offshore drilling and farming, and the like, and mining. How far offshore are you talking about?

Mr. Pierce. In the deepest water on the Continental Shelf of 1,000, 1,200 feet, for that type of operation.

However, these structures I suggested could be used in any depth of ocean. For example, if you were going to use one for a fish processing factory, it could be put wherever the fish are regardless of the depth.

Mr. Biaggi. Would these be permanent buildings?

Mr. Pierce. The concept that I have is that they would be towed to site and held in place dynamically, much like the Mohole platform or the *Glomar Challenger* ship. They could essentially be permanent if you wanted them to be. If not, you could move them around by towing.

Mr. Biaggi. Frankly, I think the mobile feature of it is more attractive than the permanent.

When you talk in terms of cities, I envisage structures that are permanently established and when the utilization is completed, you are left with a ghost city.

Thus, the mobile feature seems more desirable.

On page 4, you say something about a layman seeing the possibilities of almost immediate economic returns.

Would you be kind enough to spell out to me some of those economic returns?

Mr. PIERCE. First, by immediately, I am speaking of the next 4 to 5 years. I would say the field of food processing would be one of the areas; also mining and offshore oil as well as synoptic ocean data networks and weather forecasting which could provide economic benefit to the various people who are interested in the worldwide picture of the weather.

Those are some of the things that I believe would result in economic benefits. It is probably substantial when you relate it to minerals, and oil, and food.

Mr. BIAGGI. Are you in a position to estimate what the initial cost would be?

Mr. PIERCE. No; I am not.

Mr. BIAGGI. That is all.

Thank you, Mr. Pierce.

Mr. LENNON. Thank you very much.

Mr. Pierce, I want to go back for a minute, if I may, to the colloquy between you and Mr. Karth of Minnesota, where on line 8, on page 4, I quote:

> However, I would suggest that, first the Congress authorize and establish NOAA with at least the level of funding now being spent by the Government in oceanography.

Now, I am trying in my own mind to envision what that would entail. I assume that you are suggesting that legislation be passed establishing an independent agency such as recommended by the Commission, NOAA, but yet not transfer to NOAA of any of the agencies which are existing in Government today which involve any facet of oceanography.

Is that true?

Mr. PIERCE. That is correct.

Mr. LENNON. But you say at the same time authorize a level of funding in NOAA that is now being enjoyed by the various agencies and departments of the Federal Government who are involved to some degree in the marine sciences.

Just how could that be done?

For instance, who is to tell and when are we to tell in point of time that NOAA is going to recommend that Agency A be transferred to NOAA but in the meantime you have defunded an agency, that is still engaged in a field of oceanography?

If we take the funds and put them in NOAA and leave them out in limbo until a year or two later NOAA recommends that they be brought in NOAA, then we have to go back through the legislative and executive process to get them in NOAA.

I wish you would clear that up for me.

Mr. PIERCE. It was my intention to state that when NOAA is formed and when they have their initial program set, that these programs start with the level of funding that you have right now.

Mr. LENNON. When you say the level of funding, the level of funding related to oceanography and the several agencies which would ultimately come into NOAA?

Mr. PIERCE. Right.

Perhaps I did not state it as I meant it, but the appropriations and spending would be accomplished after the organization is set to go and those agencies that are going to be transferred are transferred.

Mr. LENNON. Let us go back to 1961, in June again, if we might.

I don't know whether you recall or not the hearings that were then conducted by the chairman of this committee, George Miller of California, and how we ran into a stalemate even on the moderate recommendations of that Commission study. We ran into a roadblock with the Executive. Then, of course, thereafter we tried to make a determination of bringing into being this Commission and at the same time bringing into being the National Council of Marine Resources and Engineering Development which would be a coordinating body at the top policymaking level headed by the Vice President and some six Cabinet officers, as well as other individuals in high places in Government.

Now, we are inclined to the opinion that this Commission made a study, and we mandated it to make a study in depth and to try to relate all the factors before they made a recommendation to the Congress as to what type, if any, governmental structure we should have and what agency should go into this particular new governmental structure referred to as NOAA.

Now, some of us are inclined to believe that we would be delayed another 2 or 3 years on the part of NOAA making its recommendation as to what agencies would go into NOAA, and I think that is more than a possibility. It is a very strong likelihood. We have been waiting now all these years.

What I want to get your judgment about—the National Council, as you know, has been mandated by the administration to make a study in depth of the Commission's report. I think the record should reflect the fact that the same staff today headed by Dr. Ed Wenk, whose staff formulated the action of the Council under the former administration, is now staffing the National Council under the present administration.

That was done through the very splendid cooperation of Mr. Mosher of Ohio, a member of this committee. I was happy to join in that request.

Now they have been mandated to make a study in depth, keeping in mind that we have actually been working with the Commission since its conception back in June 1966, up until today. They have been mandated to make a study and they have indicated their intention to appear before this committee some time after approximately the 16th of June and I assume then the National Council will make its recommendations, either pro or con, on the Commission's report.

I assume, too, that they will give the position of the national administration.

I can appreciate your thinking about it, but it gives me a little concern to have it suggested that we bring into being a new governmental independent agency, just a shell, or a paper organization, but with no transfer into that agency of any of the agencies or departments or bureaus that are now engaged in any of the fields of marine sciences or oceanography.

Don't you think that we could rely on, No. 1, the Commission's report and recommendation in this particular regard; don't you think we could rely to a considerable degree upon the recommendation of—well, let us see who they will be, the Vice President, Secretary of State, Secretary of the Navy, Secretary of the Interior, Secretary of Commerce, Chairman of the Atomic Energy Commission, the Director of the National Science Foundation, the Secretary of Health, Education, and Welfare, and the Secretary of the Treasury?

Now, that is about as strong a policymaking body as you can possibly get at the executive level.

If they make the determination that this is the way we should go, in other words, if they give their OK to the Commission's report, in my own mind I think it will do a lot to make these agencies recognize that they ought to come in and give their cooperation in spite of the fact that one or two of them who are not members of the Council at the Cabinet level, one in particular, has expressed his opposition, which is human nature, of course, that a certain native component of his Department of Transportation be transferred to this new Federal agency known as NOAA.

That is what we are confronted with. We have been frustrated now for years in trying to get this thing started. We had difficulty in 1966 persuading the administration to permit us to establish this National Council. They insisted that the Ad Hoc or Interagency Committee on Oceanography was doing a job; in fact, it was doing the best it could with the authority and policy level at which it operated.

Would you speak to that, please, sir?

Here we are soliciting your support for what we are trying to do, the way we are trying to move.

Mr. PIERCE. I cannot speak with much authority on legislative reorganization. However, from purely an administrative standpoint, my counsel is to go slow in attaching a lot of agencies to a new agency such as this until it has been determined that they really fit in the program.

Mr. LENNON. Right at this point now, you create NOAA, the President appoints an administrator and authorizes staffing.

Are you going to have any more expertise in that administrator and his staff.

The chances are he will associate himself with people who have been staff members of one or two places, either the National Council or the former Commission. Are they going to have any more expertise in making a determination of what agency should come in there than the agency or council which has been involved in this thing in depth since 1966?

How long do you think it will take these people to do again what we have been trying to get them to do and they have done now since 1966?

Mr. PIERCE. It is my opinion that it could be done in a considerably shorter period than that time. I think the programs recommended by the Commission would probably form the basis or major nucleus of the program to be handled by the administrator and that the recommendations on which agencies the administrator and his staff thought fit very well could be made very quickly. Let us say 6 months from the time the agency is formed and they have had a chance to review the Com-

mission's report and the program they have recommended. Then organize the program from an administrative standpoint of how do you organize to do the job specifically that you have in mind?

Then they say, fine, ESSA fits perfectly into this or the Coast Guard fits perfectly into that and so on, or maybe parts of the Coast Guard don't fit. I don't know enough about these agencies to make any comment on what would fit or would not fit.

I guess about all I am saying is that before an immediate decision is made that at least a reasonable period ought to be allowed this new agency to review and see if that is what they want to live with the rest of their career rather than mandating a program and mandating specific agencies at the start of the program.

I am saying, let us have a little more consideration. Not years—I am opposed to years, too, because it has been too many years now that we have been at this thing. But now that we are on the verge of doing it, on the threshold, let us take just a little more time, say 6 months.

Mr. LENNON. What concerns me, if we don't use the impetus, the thrust which has been built up to an action level through the Commission report and ultimate recognition by the National Council, I feel that the interest will wane to the extent that we cannot get the thrust that we need because even if we follow the Commission's report, assuming that the Council's recommendations are comparable, it is not going to be easy, in my judgment, to bring this into being. It is going to take a long time.

That is the reason that we are trying to build a record from people who have had expertise like you offer before we hear the witnesses who will testify representing the Government sector.

You were discussing and showing some pictures of undersea habitats.

Is it true that the Japanese have indicated their intention to build underseas habitats? Do you know anything about it?

Mr. PIERCE. I have no definite knowledge of the extent of their plans in this area, Mr. Chairman.

Mr. LENNON. Do you have any information that Florida is thinking about an underseas motel maybe off Biscayne Bay, so that people can go down there and be near the President when he is vacationing?

Mr. PIERCE. I have no definite knowledge of that.

Mr. LENNON. Somebody handed me up a little memorandum that they had read of such a suggestion. I wondered if you know about it.

Your corporate contacts have been both with the military and with space, NASA, and with many phases of the military, I assume?

Mr. PIERCE. Yes.

Mr. LENNON. And building of components.

Are there any other questions?

Mr. Counsel, do you have any questions?

Mr. KARTH. Mr. Chairman, may I just amplify one point that you are suggesting in terms of attempting to get an answer from the witness that might be a little bit more specific than one he has already given?

Mr. Pierce, if it is administratively and legislatively possible to do this in one fell swoop, as the chairman has suggested, particularly after this in-depth study which has been made by the Commission and whose

recommendations have been well thought out, if it is administratively and legislatively possible to do it in one fell swoop, would you oppose doing it that way?

Mr. PIERCE. I would not. I would say if it were easy and possible to do it without any more study on it, I would favor that even though I don't consider it the ideal way to do it.

I would say if you could do it I would not oppose that type of operation.

Mr. KARTH. Thank you.

Mr. LENNON. I think the record should reflect the fact that in most of these hearings that we have had the preponderant majority of the members attending are members of the space committee, too. I think that is an indication of their great interst. Mr. Downing and Mr. Karth and Mr. Mosher and Mr. Pelly, of course, are ranking members, and it is a great indication to me that the members of this Subcommittee on Oceanography are practical, yet experienced people in this field. They are the ones who have demonstrated, in my judgment, to a great degree the greatest interest in what we are trying to do.

I don't have the honor of serving on that committee, but I have great admiration for people who serve there and on this committee, for I know how dedicated they are.

Now, Mr. Counsel.

Mr. DREWRY. Mr. Pierce, as a slight extension of the chairman's question concerning your business in the missile and space field, I wonder if you could supply for the record a memorandum indicating something about the types of contracts you have. In other words, a little bit of the extent of your business that you have been able to develop over the past 4 years.

Mr. PIERCE. Yes.

Mr. DREWRY. We have this which you sent in before; we appreciate it. That is one reason we are anxious to have it here.

Mr. PIERCE. Are you referring to my past experience with the military and space or the present composition of hydrospaces?

Mr. DREWRY. The volume of business you have and the type of contract you have, whether in the commercial field or in the military, both in the hydro and aerospace field.

Mr. PIERCE. Would you like me to summarize an answer now?

Mr. DREWRY. That would be fine. It does not have to be detailed. I just thought for the record it might give us a little better idea of who it is that we are hearing from today.

Mr. PIERCE. Our company was originally chartered to do advanced work in the fields of oceanography and space. However, since the ocean markets have not developed, we do not consider ourselves an ocean company as yet but we hope to be when these new ocean projects are implemented.

At present, we have done considerable research in the field of oceanography and have for the past 4 years maintained research work on stable sea platforms along the lines that we have discussed here.

We have also done work in ocean wave measuring equipment, underwater communications for military purposes, and sonar fish tracking systems. We have not as yet been successful in getting contracts in the space field although in the aerospace field we have several

contracts with the Federal Aviation Agency in advanced solid state navigation equipment, instrument landing calibration systems, and voice communication transceivers.

Then we have some strictly military work.

The company's posture is one that we want to be in the ocean business but until it develops we are in these related fields as close to the type of business we want to be in, at the same time while waiting we feel these other activities exercise our talents, increase our physical facilities so that when the ocean markets develop we will be ready to capitalize on that.

Although we do not have the contracts in these fields, we are continuing the research and development and scientific discussions on this with our scientific committee which has on its membership Dr. James A. Van Allen of the University of Iowa, Dr. James Snodgrass of Scripps and Dr. Landweber of the University of Iowa Hydraulics Institute.

So far, all of our contracts have been with the U.S. Government.

We do not have any contracts in what I would call the commercial sector, as yet.

That is a brief sketch of the composition of the company.

Mr. DREWRY. That is what I wanted to get. I was not probing but I wanted to get some idea.

Mr. PIERCE. Thank you.

Mr. LENNON. Mr. Pierce, I am advised that industry has invested approximately $100 million in so-called submersibles.

Is that the figure that you are familiar with?

Mr. PIERCE. I don't know the exact figure.

Mr. LENNON. You know it is considerable.

Mr. PIERCE. Yes; it is considerable.

Mr. LENNON. I have an editorial in my hand from a national publication the Undersea Technology magazine to the effect that industry has invested a little over $100 million in submersibles.

In spite of the plea by the Navy and the Marine Science Council, $3 million which was originally in the budget to provide for commercial leasing of submersibles by the Navy to other agencies and laboratories involved in the marine science field, has been cut out.

Do you know anything about that?

Mr. PIERCE. I have read about it. I am not familiar with the details and issues and why these funds were cut out.

Mr. LENNON. It goes on to say in spite of the fact that the Government spends approximately $2,500 to $6,000 a day to run its various oceanographic research vessels that this $3 million would make possible for leasing purposes up to 300 or 400 differences by these submersibles to be funded.

If you find out anything about that, I wish you would supplement it for the record.

I took the liberty of writing to Secretary Laird about the matter when it was called to my attention. I am going to take the liberty today to insert in the Congressional Record this editorial and the reference to my letter.

We appreciate your appearance, Mr. Pierce, and particularly your interest in what all of us hope to be some action in the very near future.

Thank you so much.

Mr. PIERCE. Thank you, Mr. Chairman.

Mr. LENNON. Our next witness today, if he will present himself, is Mr. Robert L. Clark, vice president of Hayden, Stone Incorporated. Without objection, the biographical sketch of Mr. Clark will appear at this point in the record.

(The biographical sketch follows:)

Robert L. Clark is a vice president and director of institutional research with the world-wide investment firm of Hayden, Stone Incorporated, with headquarters at 25 Broad Street, New York City. He has conducted major forums and prepares reviews and forecasts on Oceanography. He has given a number of addresses on the investment outlook for Oceanography.

He joined Hayden, Stone in 1958, following 12 years spent with the Standard Oil Company (New Jersey) and its affiliates in Europe and the United States. A native of London, England, he received his early education in this country at Phillips Academy, Andover, Massachusetts, and subsequently took his bachelor's degree from Dartmouth College (1940) and his master's degree from the Tuck Business School (1941). He served in the U.S. Navy from 1941 to 1946, and held the rank of lieutenant commander.

Mr. Clark is a member of the New York Society of Security Analysts, the Oil Analysts Group of New York, the American Petroleum Institute, and the Independent Petroleum Association of America.

He and his wife, Mariana (Loyd) Clark have four sons and one daughter and live in Weston, Connecticut.

STATEMENT OF ROBERT L. CLARK, VICE PRESIDENT, HAYDEN, STONE, INC., NEW YORK CITY

Mr. CLARK. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, it is indeed an honor to appear before you today and discuss the report of the Commission on both "Our Nation and the Sea."

First of all, my appearance here before you is as a citizen and any opinions given represent my own personal views and not necessarily those of the organizations with which I am affiliated.

I would like to present to you some data and observations on oceanography contained in this pamphlet for your review and recording, as you deem appropriate. With your permission, I will forego a verbal presentation of this material and limit my remarks to a few comments about the report of the Commission on Marine Science, Engineering, and Resources.

The Commission has done a fine job in bringing together a very thorough review of all the various aspects of oceanography with emphasis on the civilian side from a Government point of view primarily, although adequate attention has been given to industry and other private institutions.

The main message that I have to bring to you is how important it is for the Government to show industry that it means "business" by effectively organizing itself now for launching, coordinating, and directing an active aggressive program in marine science and technology.

We recognize that Government funds for this purpose are under pressure right now. Nevertheless, evidence that the Government is going to organize itself to formulate and administer such a program, even if funds are limited at the present time, is vital to keep industry interested and committed to further expenditure of private funds in

this important area. A long period of drift and inaction in reviewing and studying the Commission's report would be most discouraging to industry and the investment community.

It is felt that a coordinating agency certainly is needed to provide communications among all the various different departments and agencies having marine programs, both military and civilian. Naturally, all concerned want to avoid duplication.

The proposed National Advisory Committee for the Oceans (NACO) would perform this function.

It should, perhaps, be established first, and at least, on the same level as any executive agency such as the proposed National Oceanographic and Atmospheric Agency (NOAA) and be clearly independent of this latter agency.

We would encourage strong representation be given to industry on the advisory committee and that all major spheres, large and small, such as petroleum, fisheries, recreation, pollution and construction, be included. It is also most important to have well-qualified representatives from the States of the regions along the coast and Great Lakes on such a committee.

An executive agency, such as NOAA, to formulate and direct many of the more important marine operations of the Federal Government in the civilian sector would seem to be desirable, even essential.

Naturally, an interdepartment agency mechanism to coordinate the various marine functions of the departments and other agencies is vital and should, of course, provide coordination with the Navy.

The modernization of the U.S. fishing industry, particularly the catching and harvesting end of it, is urgently needed and requires encouragement from the Government. It should be made clear that a leading mission of the Bureau of Commercial Fisheries is to place primary emphasis on increasing the U.S. fish catch on an economic basis.

Perhaps encouraging the Bureau with a new sense of purpose could be best accomplished by assigning it to this new agency, if established. In addition, the civilian operations of the Coast Guard might well be more attuned to assisting in the accomplishment of oceanographic missions, if it were assigned to NOAA as long as it did not jeopardize its important military mission to the Navy.

If the atmosphere is to be considered a part of NOAA, as proposed by the Commission, and ESSA is to be included in this agency, then perhaps air and water pollution control programs, so vital to our environment, should be very closely coordinated and supported and maybe even affiliated with NOAA. Certainly, it is vital to encourage programs which will improve the accuracy of forecasting the weather. Advances here would have tremendous benefits both to the Government as well as industry.

We definitely agree that the main Government role should be to provide seed money to act as a catalyst in activating industry in its marine research and development operations and that direct Government subsidies should be avoided at all costs, except possibly in the construction of modernized fishing vessels.

However, even this subsidy might be unnecessary if U.S. operated fishing vessels could be built in the lower cost shipyards abroad. The building of plants by the Government, for example, to make fish protein

concentrate, should not be authorized. Purchase of the product by Government contract would be the much preferred approach.

Where resources are involved, and there are not pressing security considerations, economics should be the determining factor in deciding whether, for instance, fish is the cheapest source for protein or is there some more economical product. The test of whether the land or sea is the cheaper source for any resource must, naturally, be applied to minerals, chemicals, and drugs, as well as oil and gas.

It is clear that the petroleum industry is by far the largest natural resource factor in oceanography. It is now well recognized that more stringent offshort drilling regulations are not only required but must be strictly enforced. They should be practical and not punitive so as to encourage development of the extensive oil and gas reserves off our continental shelves.

Larger lease blocks should probably be offered in strictly exploratory areas, such as off the east coast, than the present 5,760-acre blocks. After all, the prospective structures do not stop at the Canadian line of our Continental Shelf. A lot of leases have been granted north of the border and further drilling is planned off Nova Scotia and Newfoundland.

Programs for conservation and development of our coastal areas, both lake and ocean, are urgently needed. Here, the cooperation of State and municipal authorities is essential together with the investment community.

One approach would be to form quasi-public corporations, at least, partially financed by revenue or even discount bonds which might have preferred tax-exempt status. Here, the initiative and leadership of the Federal Government are vital to energize such programs for the various regions concerned such as the Atlantic, gulf, and west coasts, and the Great Lakes.

Urban renewal in many of our large cities, pollution control, and marine recreation are all involved here.

Although controversial, still having merit, at least, part of the substantial funds received by the Federal Government and many coastal States from offshore bonuses on lease sales and royalties on production, be used to assist in funding oceanographic research and development, pollution control, as well as all the excellent objectives to be achieved by the proposed Coastal Management act and State coastal zone authorities.

It is also very important to clarify, as soon as possible, the many open jurisdictional questions of who owns what, where. I would perhaps take exception to the 50-mile or 200-meter depth limit proposed by the Commission in reference to the natural resources a country could claim as under its sovereignty off its shores.

It might be more practical to operate under the principles established by the United Nations Convention for the Continental Shelf, namely, determining a jurisdiction beyond the depth of 200 meters by the technical ability to exploit the ocean bed.

I would not like to see us give up a claim to the sovereignty of the ocean bed embraced by the Continental Shelf, the slope, and the landward portion of the rise. I would be much more inclined to support the proposals on jurisdiction over the natural resources of the ocean bed

contained in the National Petroleum Council's recent report on "Petroleum Reserves Under the Ocean Floor" to the Department of the Interior.

Furthermore, the coastal States and the Federal Government need to settle offshore jurisdictional claims much more expeditiously than heretofore and to establish property rights in leasing the ocean bed out for development to encourage aquaculture and other marine operations on our Continental Shelf and along our coasts. Private industry needs to have property rights established for it to commit funds.

In conclusion, I would emphasize again that the Government basically "has the ball" right now. Even though there are obviously other vital programs pressing for Government funds, still an organization could be established now as a start, by forming NACO to work with the Council during its 1-year extension period.

The further organization of the Government for its oceanographic program could then be planned under the direction of a new agency, either as part of a newly formed Department of Natural Resources or as an independent agency appointed by and reporting to the President.

One final thought that is not in the prepared remarks.

It is important for Congress to centralize in its committee structure its handling of oceanography and marine-related programs and perhaps the focus in the House rightfully belongs here in this Subcommittee for Oceanography.

Thank you for the opportunity, Mr. Chairman, and members of the committee, to appear before you.

Mr. LENNON. Thank you, Mr. Clark.

We hope to agree with you ultimately that the jurisdiction and authority will be not necessarily in this subcommittee but in this general committee, at least; because of the agencies that are proposed to go into NOAA this committee or the subcommittee has jurisdiction of all of them except ESSA and actually we have jurisdiction over part of ESSA.

The gentleman from Washington, Mr. Pelly.

Mr. PELLY. Mr. Chairman, I would like to say to Mr. Clark that I agree with you almost 100 percent in your approach to this problem.

I have listened to you with tremendous interest. I could not find anything with which I could quarrel at all. On one point, however, I don't recall that the Commission in its consideration of either the 50-mile or the 200-meter mark ever went so far as to make a definite recommendation. I thought that their program called for clarifying the vagueness in this field.

Mr. CLARK. Maybe I might be allowed to address myself to that comment, sir.

The Commission did make, as I understand, and I am not a lawyer, did make a recommendation of exclusive sovereignty over the natural resources at 50 miles or 200-meter depth, whichever embraced the larger area. Then they went on and proposed an intermediate zone which I believe would be composed or 2,500 meters or 100 miles, whichever embraced the larger area, and that the coastal State would have the right of access to this but that an international registry agency would be formed and an international funding organization also would be established to which certain royalties on any natural resources that

were exploited in this intermediate zone would be paid and in effect this does, I think, dilute our sovereignty over the natural resources as we understand them at least in the United Nations Convention Regarding the Continental Shelf.

If I might go on to amplify, next month will be the first time that this convention can be renegotiated, the United Nations Convention, and there are proposals to form an international regime.

So, as a citizen, I am concerned that we look after our own interests and our own resources.

Mr. PELLY. I may say this committee has indicated its concern and we do not want to see any dilution of our sovereignty.

We have had hearings and, indeed, legislation on this very subject. We have tried to get our State Department to indicate exactly what its position is and have failed completely so far as I am concerned to be assured that there will not be some dilution.

The position that I, personally, take is that we were given sovereignty up to the 200-meter contour and beyond where we could exploit it. I think that is clear, and I do not believe by treaty through the United Nations anyone has the right to give away that sovereignty other than by action of both the House and the Senate, as required under the Constitution whenever property of the United States is to be given away.

I am glad you have commented further on this and I certainly want to say that you have made a very fine statement and one which I subscribe to completely as far as private enterprise and the national interest is concerned.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you.

Mr. Karth.

Mr. KARTH. Mr. Chairman, I certainly agree with the gentleman from Washington that private industry and the Government ought to engage in a cooperative program.

I am not really sure I understand what Mr. Clark is proposing but it seems to me that he is proposing quite a substantial departure from the Commission's recommendations in terms of administration and organization.

If I understand your proposal correctly, you are suggesting that the National Advisory Committee for the oceans pretty much take over the responsibility that the Commission is recommending for NOAA. You talk about an advisory committee to the National Advisory Committee for the oceans being comprised largely of private industry people and to that I see no objection.

Then you talk about that executive agency formulating and directing many of the important marine operations of the Federal Government in the civilian sector as being that which you desire, which for all practical purposes, it seems to me, replaces what NOAA is supposed to do and what the Commission recommends they do.

I wonder if you would clear up whatever misapprehensions I have or misunderstandings I have about your suggested administrative procedure.

Mr. CLARK. Yes; I would welcome the opportunity of clarifying this point here.

It is not my intent at all to suggest that NACO take over the executive responsibility of directing the program.

To keep the record straight here, on page 2, at the start of the last paragraph there, "An executive agency to formulate and direct many of the more important marine operations," I am referring to NOAA in that context. That would be the executive agency, sir. Perhaps I should have spelled it out.

Mr. LENNON. Will you yield to me?

Mr. KARTH. Yes.

Mr. LENNON. That is exactly the point I was going to raise. It confused me, too.

Thank you.

Mr. CLARK. Does that clarify it?

Mr. KARTH. I am glad the witness clarified that.

I was also associating that with the previous paragraph where you talked of the executive agency.

Mr. CLARK. No; the first paragraph refers to the committee; the second to NOAA.

Mr. KARTH. Thank you.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you, Mr. Karth.

Mr. Keith?

Mr. KEITH. Thank you, Mr. Chairman.

I think that from two points of view this is a very worthwhile statement you have made.

I would gather that as one who is sort of an agent of the business community that you know that you cannot get funds for a development unless the title is clear. This is particularly true when you are dealing with the matter of stocks and bonds and borrowing from banks. So that part of your statement points up a problem that must be recognized.

The second contribution is one which I think this committee has recognized and that is that you have to have clearly defined lines of communication and policymaking and responsibility for funding so that your operations are not so open ended and fuzzy that you can't proceed with some confidence that this won't be changed from day to day.

The implementing of the report and creation of the agency asked for here will go a long way toward resolving many problems that have confronted the Congress before in connection with oceanography and related projects. This would be the case when there is a difference of opinion between one agency of the Government and another.

We should have a prestigious organization that could help to make a decision. For example, in the case of operation Mohole, there was no agency of the U.S. Government that said it was right in the first place, no central agency. There was no central agency to come to us when it ran into rough seas. The organization that did more or less implement that act was an ad hoc one.

I think this committee is moving forthrightly in its effort to resolve the problems that it has seen and to enlist the public support such as yours that we need. We are hopeful that we can generate through this series of hearings, leaders like yourself, Dr. Stratton and others.

Now, just one little observation or question to get you on an operating level.

You say that the Coastal States and the Federal Government need to settle offshore jurisdictional claims much more expeditiously than

heretofore and to establish property rights in leasing the ocean bed out for development to encourage aquaculture and other marine operations on our Continental Shelf and along our coasts. Private industry needs to have property rights established for it to commit funds.

What is the situation in Connecticut with reference to aquaculture? Do you happen to know?

Mr. CLARK. You see that I am a resident of Connecticut, I guess.

Mr. KEITH. That is right.

Mr. CLARK. Of course, the pollution situation is acute there. The former clam and oyster beds are really declining to a point where there is very little industry left.

There are, I understand, some efforts being made to revive this up along the northeastern part of the coast but it is still on a very low key, I would say.

I do know in Long Island, for instance, that there are a few oyster farms you might say this might be aquaculture, oyster raising projects going on there, but this is more on the New York side than on the Connecticut side.

I would like, if I may, to make a couple of observations on your comments.

No. 1, we in industry and in the investment community are very encouraged that this committee has taken the initiative in holding these hearings and to get the ball rolling. I think you are performing a very important function here by holding them and we are delighted that you are receiving and hearing representatives from industry in connection with your deliberations.

The other comment that I would like to make—you referred to the Mohole project and the JOIDES, by Global Marine. That is what resulted after the overall Mohole project was abandoned, that they have found cores taken in the deep ocean waters that are very interesting, very significant. And here is a very excellent example of where a Government research project is providing valuable data to industry that may eventually be of commercial use.

Mr. KEITH. Do you happen to recall how much money was spent on Mohole before it was abandoned?

Mr. CLARK. I do remember that the final cost estimates, if there is ever a final cost estimate these days, ran into hundreds of millions of dollars and the JOIDES project is perhaps finding a lot more out for a lot less money.

Mr. KEITH. I wondered what the JOIDES project has reaped in dollar value from the inheritance from Mohole. Your statement indicated that there was a spinoff from Mohole that has some value and you gave an illustration of how industry profits from such an effort.

I would like to find that it is substantial but I would rather suspect with reference to the $35 million or $40 million that was expanded——

Mr. CLARK. I am not in a position, sir, to be able to detail what spinoff there might have been from Mohole to JOIDES.

Mr. KEITH. By the way, with reference to aquaculture, I think that that is a States rights responsibility at the moment. Most of the aquaculture effort is within the 3-mile limit. We have the same problem in my district that you have along the Connecticut shoreline.

We had an extraordinarily competent witness here yesterday or the day before from the National Oyster Institute before Fisheries and

Wildlife who described some of the problems they had had. In 1908, I believe a doctor, I think from Massachusetts, wrote a treatise that is just as applicable today as it was then with reference to the culture of oysters and I believe clams and quahogs.

It is worth studying today because of the problems not only of pollution but of local politics.

If you want to improve the plans for aquaculture, I think the State level is the place to go and that would be a good source of information.

Other countries, as you know, are doing much more than we. I think Japan exports to this country tremendous amounts of shellfish.

I was interested in what you have to say about the fishing vessels and about fish protein concentrate. I basically share your feelings with reference to the building of plants by the Government. Of course, you get into the political position of who gets it and where it gets located. Private industry in that case could not proceed and I begrudgingly went along with the committee's recommendation that we fund a fish protein concentrate plant. The Government had so handicapped the industry that eventually the private sector had to be subsidized in order to make it successful.

You talk about the construction of modernized fishing vessels and how the subsidy might be unnecessary if U.S.-operated fishing vessels could be built in the lower cost shipyards abroad.

We have a Fishing Vessel Subsidy Act which expires June 30. I think it is a fact of political life that Congress is not going to repeal in the foreseeable future the act that makes the building of fishing vessels mandatory in this country. So, we have to deal with that reality.

If you have any observations as to how that act might be improved to make it easier for us to operate fishing vessels and how it would relate perhaps to this report, I would be interested.

Mr. CLARK. Well, sir, I do not represent myself as an expert on the fishing industry. There really isn't a fishing industry as such in Wall Street. Most of the fishing operations have been done by independent fishermen. The distribution, of course, is handled by divisions of many of the large companies. So we do have some exposure there.

I would say that the recommendations in the Commission's report in this area are sound and we would support them. I think they did make reference to certain improvements that could be made in this subsidy, the Fishing Vessel Subsidy Act.

So, if I could just refer to those as perhaps what should be considered in the extension of the act.

I appreciate very much what you say about living with the political facts of life and that this suggestion about constructing vessels abroad probably, you know, is—I hate to use the word—but is academic. I thought that might be the reaction.

Mr. KEITH. It is a long way from Wall Street to this committee occasionally.

One final observation.

You suggested that they could go ahead with NACO first. This was discussed by the committee, and I think Dr. Stratton spoke to this subject in response to some observations that were made by Mr. Lennon and myself, and so you may find that the hearings will be very helpful to you in answering those observations that you made.

Thank you, Mr. Chairman.

Mr. LENNON. Thank you.

Mr. BIAGGI. Thank you, Mr. Chairman.

Mr. Clark, your presentation is salutary.

On the question of where you projected industry in relation to the proteins resources and the like, I posed a question earlier to the preceding witness, Mr. Pierce, and received a general response which really was not as detailed as I would like.

He stated that the program would be received with as much enthusiasm, if not more than, the current space program.

My observation was that the space program's enthusiasm is waning despite the successes because of the economics of the day and the needs domestically, hence a proposal to undertake this oceanography program might not be received as well by the people unless we can justify it.

The question I asked was, what would be the spinoff, what would be the immediate returns to the public?

I wonder if I could obtain from you something more specific, something that could be translated and quickly recognized by the laymen as justification for this program.

Mr. CLARK. I am trying to search for a direct way of answering this question that the laymen could feel and sense, like putting up a new apartment building in a ghetto area of the city that he could move into and feel and sense. I think there is a lot of competition for funds, in the social area here, if I have the thrust of your question. This is some of the thrust of it, perhaps.

Mr. BIAGGI. Confined to the construction of the ghetto areas or social problems, let us deal with food problems, why can't this protein process be just as effectively handled on shore from the practical point of view. What would be the difference?

We talk about minerals. How necessary are these minerals? What impact would they have on the Nation or on people?

Those are just a few things that come to my mind.

Mr. CLARK. Yes. I can answer the question for the country and for people and their future, but to be able to say that if we put a lot of money into FPC, that the man in the street is going to be able to eat better and get more protein in the United States, I think the FPC, you know, this food from the sea talk, is a way of making the man in the street feel the program and has really been overdone. This perhaps is not in line with many people's feelings on this.

I must say that I think it has to come down to economics. We are in a research area on FPC and the economics are still in question, as far as I can determine, and the sources to which I am exposed, as opposed to other sources of protein.

I think here we are dealing with the security of the country. We are dealing with our natural resources. We are dealing with weather. I think on better forecasting of the weather, for instance, as an individual I hardly ever look at the weather forecast because it is so unreliable. I am asked what is the weather forecast for today. I rarely know what it is because I don't plan on the basis of the forecasting that is done now because, as I say, it is unreliable. This is not a criticism. It is just the primitive state of the art.

Maybe weather, this touches everyone, if we could show through ESSA and through the buoy program, which, as you know, I think

is suffering here, that to the boatowner and to the fellow who is going away for Memorial Day, that he can go to Maine like I am looking forward to doing this weekend and, you know, count on good weather; this would mean a lot.

This would mean a lot to industry and business to know and even be able to control the weather. This, I think, is down the road as a possibility.

But we do need, I think, a strong, energetic, and well-funded weather research program. I am all for the atmosphere and the environment being brought into oceanography. They are interrelated.

Mr. BIAGGI. I do not quarrel with the research aspect of it and I agree with you. The point I am making is from where you sit, and from where Mr. Pierce sits, you should address yourselves with the same amount of vigor to selling this so that we have public acceptance. I can foresee resistance. We are finding it now to be one of the most successful programs in the Nation, the NASA program, reaching the moon. It is probably one of the most successful and productive in our Nation and yet we are finding increasing resistance.

So, it is almost mandatory that the public acceptance facet of your presentation should be really addressed with additional vigor.

Mr. PELLY. Would you yield, Mr. Biaggi?

Mr. BIAGGI. Yes, sir.

Mr. PELLY. I am conscious of the fact now that a great deal of thought has been given to malnutrition and there are said to be 16 million people in this country that are either hungry or undernourished. Yet, I gather from what you have said that you don't see any economic benefit that might be obtained from fish protein plants.

Well, we have developed an experimental plant to try to lower the cost of this product and we have sent fish protein abroad to be fed to other undernourished people. I think anybody who has studied population growth and the problems of this terrible situation in which the world finds itself, and the need that we are going to have for fish proteins, will conclude it will be one of the most economic and exciting programs if properly presented.

The private food people said that they didn't have an economic capability to do the experimenting. They so testified before our committee and we provided for a fish protein experimental pilot plant. With all this resource that we have off North Carolina and the west coast it seems to me that we have a magnificent opportunity for private investment to go in and develop a product for which there is a tremendous need with 16 million hungry people in America.

So, I think that Wall Street should see the opportunity that exists here and get into this business.

Thank you.

Mr. BIAGGI. I have no further questions, Mr. Chairman.

Mr. LENNON. Thank you, sir.

I think we should recognize the fact that the Department of the Interior in its oil leases, petroleum, oil, and lubricants, brings in to my recollection somewhere around $600 million to the Federal Treasury each year and that is projected in the next few years to go considerably beyond that.

We must recognize that that is related to the field of marine engineering, not necessarily oceanography.

I am reminded of the fact that the discovery of phosphate magnesium, by some oceanographic vessels has resulted in leases which in turn has brought a considerable amount of money into the Federal Treasury through the Department of the Interior.

I am reminded, too, of course, that we must increase our fishing capacity. I would say 70 percent of the edible fish that are consumed in this country come from other countries. We have that potential.

We heard yesterday—of course, we knew it before—that last February or a year ago the Federal Food and Drug Administration finally approved the so-called fish protein concentrate and the Alpine Co. has a contract now with AID for 2 million pounds. They have already delivered several thousand pounds. We have asked them to furnish for the record those companies overseas that have the contracts to purchase that under AID.

I am reminded of the fact that we are trying to get the Federal Food and Drug Administration to authorize the sale of the fish protein concentrate in quantities other than in one pound packages which can be used by any number of our food manufacturers, Heinz, Campbell's, General Foods, you name it, for use in various types of macaroni and soups and cereals and other things. It is a concentrate which they say to us quite excitedly will alleviate malnutrition.

Now, coming back to your statement, sir, I commend you for it. I am impressed by it because I do believe that you have read the Commission's report so I know that you know that this committee and the Congress has extended the life of the National Council for another year. I will get to that in a minute.

But, on lines 2 and 3, you make this statement:

> A long period of drift and inaction in reviewing and studying the Commission's report would be most discouraging to industry and the investment community.

With that, I agree. Yet here on page 6, you suggest a possibility of reforming the National Advisory Committee on Oceanography to work with the council during its 1-year extension. You say that then we may move to an oceanographic program such as through the media of a newly formed Department of Natural Resources or as an independent agency.

What is the objection, Mr. Clark, in your judgment, to moving explicitly and directly as the Commission has recommended in its report, No. 1, establish NACO?

Now, that leads me to raise this question that you raised in my mind in which you suggest on page 2 of your statement, at about line 9, that NACO should probably be established first, that would be the National Advisory Committee on Oceans. Now, that suggestion has come from a previous witness.

Now you go on to say that it should be established on the same level as an executive agency such as is proposed under NOAA.

Now, a National Advisory Committee on Oceanography which would have in its membership representatives of the petroleum, fishery, recreation, pollution, construction, and so forth, could not be an executive agency.

Now you may have that in the country of your birth under the parliamentary procedure where if you don't get a majority you get a new

election, but not in this country. In other words, you could not have a Commission with executive authority that was composed of people at the private level.

Do you see what I am talking about?

Mr. CLARK. Yes, sir. I welcome your questions in this area.

Mr. LENNON. Under the recommendation of the Commission's report, the members of NACO would be appointed by the President and confirmed by the Senate, but they would be a presidentially appointed Commission, but they would be authorized to advise and counsel with NOAA and to represent all of the spectrums of private industry that you have enumerated in lines 15 and 16 on page 2.

Now, I can see that if this committee ever comes to the conclusion that it cannot move in the direction all the way with the establishment of a governmental agency such as NOAA that it certainly would be practical, in my judgment, for us to go ahead and insist upon enactment into law of the recommendations related to the establishment of the National Advisory Committee on the Oceans and let the President appoint that committee. Hopefully to go back and pick up at least several of those people who served so splendidly on the Commission that was appointed by the previous President because it was a nonpartisan group, as could possibly have been appointed.

What is your objection or do you see any objection why we can't do both simultaneously even in the same draft legislation? Provide just as we did under the other bill, we established a National Council and we also established the authority of the President and mandated him to appoint the Commission.

Why can't we, in the same piece of legislation, establish the Advisory Committee on the Oceans that you have recommended, and in the same legislation establish NOAA and bring in the basic groups from the several agencies that are related to oceanography? Then when we move on the National Advisory Committee on the Oceans they will be required to make their recommendations to the Congress and to the President on an annual basis under the recommendations of the Commission, as to whether or not we should keep in NOAA those agencies that we put in there originally. Whether we should take some out or whether we should bring some others in could be decided then.

What is your basic feeling about that recommendation, that thinking?

Mr. CLARK. Well, sir, perhaps someone coming from industry should not consider the political problems that may be faced and should present his views on an ideally efficient and effective systematic approach. Perhaps I was addressing myself to some of the political problems that obviously arise when recommendations are being made to transfer agencies from one department to a new agency, let us say.

I have no objections, I would like to emphasize, to the establishment of NOAA with the transfer of the various functions basically as proposed by the Commission at the same time as NACO, the advisory committee, is appointed.

I would have objections if there were going to be an unusual delay in doing anything because we were getting politically bogged down due to this interdepartmental question as to what was going into NOAA and what was not, so that nothing happened.

I would prefer to have the Government show its interest by at least appointing the committee rather than doing nothing for some time, you see.

Mr. LENNON. With that, I can agree, and that may be exactly what the witness had in mind a few days ago when he suggested that the first action of the Congress should be the creation of the National Advisory Committee on the Oceans.

He didn't say so but he might have been anticipating the inability of the Congress, working with the executive branch of Government, to enact legislation that would create not only NACO but also NOAA, the governmental structure for the administrative organization. But we have the responsibility to proceed in both directions, and if we are in a stalemate in the future we will just have to move that way.

Now, I would like to ask unanimous consent, gentlemen, that there be placed in the record immediately preceding Mr. Clark's prepared statement his career résumé.

I have had an opportunity to look over rather hurriedly but yet to the extent that I am gratefully impressed with it, some material which was submitted by Mr. Clark and by someone else, I assume, Mr. Stuart Clement, Jr.——

Mr. CLARK. Yes, sir; he is an associate of mine; second vice president.

Mr. LENNON (continuing). "Data and Observations on Oceanography," presented to the committee, dated May 28, 1969, and which seems to me to be an analysis of the report of the Commission on Marine Sciences, Engineering, and Resources. Is that a fair statement?

Mr. CLARK. The first section is devoted to an analysis of the Commission's report; that is correct, sir.

Mr. LENNON. And American Management Association considerations in the field of oceanology operations, which meeting was held in New York on February 26, 1969, at the Americana Hotel.

I think it is a very fine document. I am so much impressed with it because it covers so many areas that I would like to ask unanimous consent of the committee that it be placed in the record following your colloquy with the several members.

Mr. PELLY. Mr. Chairman, I would like to second that motion. I think it is a very fine document to add to our record.

Mr. LENNON. There is only a small part of it that is related to finance but that in turn is inextricably related to the development of marine science as I read what is said here with respect to the various companies which have considerable investments in the various marine science fields.

I will ask unanimous consent that it be placed in the record immediately following the colloquy with the members of the committee.

(The document referred to follows:)

Data and Observations on Oceanography

REPORT OF THE COMMISSION ON MARINE SCIENCES, ENGENEERING AND RESOURCES

The Commission has proposed new Federal Government programs in marine science and technology which would require additional funds of around $800 million a year, nearly doubling the estimated $900 million currently being spent for civil oceanographic activities. Thus, the combined programs, present and proposed, if continued and approved, would involve Federal Government expenditures of close to $18 billion during the decade of the 70's, including an annual provision of 3% for inflation. The increases would probably be more rapid in the early part of the coming decade and level off as the programs reach maturity toward the end of it. As a result, there could be a rapidly increasing trend of Government funding for oceanography during the early 70's. The table shows that spending by the Federal Government on civil oceanographic activities may triple from the present level of $900 million to $2.7 billion by 1980 and grow at an average annual compound rate of 12% including a 3%-inflation factor.

LEVEL OF SPENDING ON CIVIL OCEANOGRAPHY BY THE FEDERAL GOVERNMENT

Annual			
1969	$0.9 Billion	Decade of 70's	$17.0 Billion
Proposed new programs by 1980	1.1	3%-a-year inflation factor	.7
	2.0		
3% Inflation factor	.7		
Total-1980	$2.7 Billion		$17.7 Billion

Annual growth rate 12%

The Commission, in its terms of reference, has taken a broader view of what encompasses oceanography than has the Council in its present budget, which is approximately $525 million. The Coast Guard and Environmental Science Services Administration (ESSA), are two activities which would become a part of the proposed National Oceanic and Atmospheric Agency (NOAA), according to the recommendations of the Commission. The Bureau of Commercial Fisheries, the National Sea Grant Program, the U.S. Lake Survey, the National Oceanographic Data Center and the Bureau of Sport Fisheries and Wildlife would likewise be transferred to this new independent federal agency which would report directly to the executive branch of the Government.

The Council is currently reviewing the Commission's report for the Vice President so that the new Administration may decide what action to recommend to Congress and to the other executive agencies of the Government in implementing it.

Congressional hearings will probably take place some time later on this spring and, hopefully, concrete action will result in launching at least a good part of the new program as proposed by the Commission during the coming fiscal year. The Government now plainly has "the ball" to convince the private sector of the economy that it means "business" in oceanography. The Council will probably continue to function until Congress and the Administration have acted on the Commission's report. It is obvious that some sort of effective coordinating agency is needed to spearhead existing and proposed programs. If it is established with sufficient authority, it should result in an energetic and aggressive program for oceanography in the 70's. The thrust from the Government would be research, leaving development mainly to industry.

We feel encouraged at the breadth of the proposals by the Commission. We hope that the Administration and the Congress will provide the necessary follow-through. This year may well be a decisive one in determining the Government's role in oceanography. We are glad that subsidies have not been recommended and feel that the Government's role is properly to concentrate on research and, of course, security together with clarifying legal questions with other governmental bodies. Industry will respond, we are sure, as it has already started to do, when the government program starts to shape-up and seed money is laid on the line to provide the catalytic effect and incentive to business, as well as to the many coastal states and municipalities.

Involving the Coast Guard in more of an active oceanographic role, especially in peacetime, makes a great deal of sense as does bringing the Bureau of Commercial Fisheries directly into an ocean-oriented agency, where it would probably be a more effective influence in providing leadership and guidance to the fishing industry.

As air and water are so inter-related in providing our environment, including the weather and avoiding pollution, we are strongly in favor of including the atmosphere in the proposed agency's domain. It should help spark lagging pollution abatement programs.

Our views about the relative investment merits of oceanography's main areas of activity were discussed in the following talk.

AMERICAN MANAGEMENT ASSOCIATION MEETING ON OCEANOLOGY

Tuesday - February 26, 1969 - - - Americana Hotel, N. Y.

SUBJECT: "Management Considerations in Oceanology Operations - Financial"
By: Robert L. Clark, Vice President, Hayden, Stone Incorporated

We, in Wall Street, are often accused of setting and following fashions in the Stock Market. Certain groups of stocks are in style - like those of companies in the nursing and mobile home business, including house boats and now even floatels!

Such companies, whose stocks are currently in vogue and are selling at relatively high price-earnings multiples, find making acquisitions and financing them much easier than those in groups which are out of favor - such as conglomerates and offshore drilling companies, for instance. Right now, I guess one can say nearly the whole stock market is out of style with investors except for hedge funds with short positions! But it will pass, it always has, and new styles will take over.

We in Wall Street try to take a hard-headed approach in appraising the financial outlook for various aspects of oceanology. A very simple question must be posed: which is the more economical source for materials, supplies, food, in the commercial market, now and during the next several years - the land or the sea? Naturally, security and defense considerations are decisive in the military market. The amount of funding by the Government will be vital in determining how attractive the civil government market will be. The Commission has proposed that the current expenditures for marine research and development, on an annual basis, be doubled to the $2 billion level by 1980, without allowing for inflation.

To try to set the stage in briefly outlining our views about the financial outlook of the diverse sections of oceanology, which we think management should be considering in searching for and developing a participation in the growing oceanic market, let's break it down into its many components. First, oceanic companies are forming, which are providing an integrated, systematic approach to operating in and on the water, including the ocean beds. Zapata-Norness, represented here today by Bob Gow, is an excellent example of an oceanic company which is now proposing to enter the shipping business. It already is engaged in offshore drilling, fishing and marine construction operations. Those companies which already have a public market for their stocks are in a much stronger position to finance other operations and attract firms to be acquired. We would advise smaller, privately-owned companies to go public only if they have a recent record of profitable operations.

Now, what is the financial outlook for the main sectors of the market?

1. Petroleum Offshore is a dominant part of the commercial oceanic market and is providing a strong thrust for industry to enter the ocean on a profitable basis. The extensive oil and gas reserves which are located in the continental shelves of the world, represent a substantial reservoir of energy for the future, not to overlook the present. Increasing amounts of oil company budgets are going offshore providing a great opportunity for firms to service and supply these requirements. Over $2 billion a year are being spent by this industry in the worldwide offshore search for oil and gas. Such expenditures are increasing at an annual rate of some 15% and will probably total over $30 billion during the coming decade. We would encourage the smaller independent oil and gas companies to take participations in offshore leases especially off the U. S. continental shelf. We also feel that there are opportunities for business in providing services and supplies to the offshore operations of the oil companies. Financing, if the company is public, can be done by offerings of security issues generally having an equity "kicker". Loans against two and three year drilling contracts may be another

approach in financing multi-million dollar drilling vessels despite the relatively high interest rates. Obviously, insurance is a financial consideration for management and these rates have increased. Some self-insurance may be used in minimizing these expenses.

It is clear that more stringent offshore drilling regulations are going to be adopted as a result of the well publicized oil spill in the Santa Barbara Channel in federal waters off the coast of California. We anticipate that offshore operations in the Channel, which have been temporarily suspended in the federal area, will be resumed, at least in some sections. The service and supply companies should be the main beneficiaries of these new regulations which will, undoubtedly, involve the use of more casing, cement, mud and blow-out preventers.

The discovery in Alaska's North Slope bordering the Arctic Ocean of substantial oil reserves is developing a big market for firms which can operate and transport supplies in an extremely cold climate. There will be a market for platform installations in and through very deep ice formations overlaying the Arctic Ocean and the earth. We, therefore, would recommend that offshore construction firms develop an expertise in Arctic operations.

2. Mining Offshore, we agree, is relatively unattractive for some years to come and should be regarded as in a very preliminary exploratory stage. It is still considerably cheaper to mine hard minerals from the land as opposed to the ocean bed. Companies willing and able to be patient, as some are doing, might accumulate acreage positions in prospective coastal areas where the water depth is minimal.

3. Marine Construction, we consider to have considerable potential, not only in view of the petroleum industry's growing operations offshore and its substantially larger and deeper draft 200,000-to-300,000-ton tankers now being launched, but particularly because of the need to improve our harbor and dock areas tied in with the urban renewal programs of many of the large coastal cities. Planning should provide for city transportation centers for air, land and sea service. Furthermore, security considerations undoubtedly will provide a requirement for some sort of underwater installations on our continental shelves. Thus, we would encourage shore-oriented construction firms to enter and expand their marine construction business.

4. Marine Recreation is a rapidly growing sector of the oceanic market. Scuba diving has become very popular and house boats are the rage rather than trailers. An excellent example of the profit motive in marine recreation working to support research efforts is Tap Pryor's Oceanic Institute in Hawaii. Here, a seaquarium, with popular shows for the public, is supporting a growing research institute and test range for marine science and technology. Companies might consider entering into such ventures in other coastal sectors of the Mainland. There are already examples of such activities in Southern California, for instance, at least on the recreation side. Yesterday, Vice President Agnew referred to public-private partnerships for coastal development. California, and also Florida, have been

considering the establishment of public-private corporations, a la Comsat, to develop projects along the coasts and estuaries of their states as a source of financing.

5. Water Pollution Abatement or Water Management Control is gaining momentum, but requires not only government regulations at the federal, state and municipal level, but also adequate financing. Yesterday, Vice President Agnew spoke of his success in gaining the approval of the Maryland Legislature, while he was Governor, of a $130-million bond issue for pollution abatement in his state.

6. Desalination presents limited opportunities in certain areas. New processes are being developed to lower the cost of making fresh water from salt water. The outlook here has been setback considerably by the scrapping, due to the substantially higher projected costs, of the proposed Bolsa Chica project for generating electricity and making fresh water out of salt using nuclear energy in Southern California.

7. Chemicals and Drugs from the Sea, we regard as relatively unattractive as synthetics and natural sources from the land are generally much more competetive. A great deal of research needs to be done here.

8. Food - much is being said about what needs to be done to stimulate our domestic fishing industry. Progress will take time, money and research. Undoubtedly, viable projects will develop in certain areas which will be profitable. Here government initiative is needed to remove the many local jurisdictional problems about which Mr. Crutchfield spoke yesterday. The FPC program has government support. Here again, the test must be, what is the cheapest source of protein?

9. Shipping and Shipbuilding are very cyclical and receive government subsidy. Containerization does provide opportunities for economies. Perhaps there are some opportunities for specialized shipping and shipbuilding.

10. Marine Electronics and Instrumentation are areas of great potential which need research and development as the Commission has pointed out. Communications in the sea, sonar, T. V., lighting, underwater habitats, submersibles, rescue and safety operations in great depth, all need support. Here government research funds must become an important source of financing as budget pressures from Vietnam ease. We look at government funds as seed money providing the catalyst to activate industry in the sea and particularly in this area.

11. Weather Forecasting and Control, including the monster buoy and the balloon program, data gathering, mapping the ocean bed, are additional activities which will be receiving increasing attention.

We have touched on many sectors of oceanology. Venture capital funds are available for projects which may not render immediate returns. I could foresee that the growth of mutual funds and particularly ones featuring investments in oceanology, such as the Oceanic Fund, represented here today by Dick Peffenbach,

would be a source of capital for private companies, especially when circumstances seem favorable to their becoming public in a year or so. Wall Street may then be ready for oceanography in answer to Admiral Waters' aptly put question "Is oceanography ready for Wall Street"? There is, indeed, a continuing interest in the financial community in oceanology. It is regarded as a new industry with great potential in the years to come as it emerges onto the industrial stage.

As the needs develop and the budget pressures lessen from Vietnam, financing, both private and public, will, we feel sure, be available to make our waters and ocean beds contribute an increasingly important share of our Gross National Product and to our country's security.

In conclusion, it might be well to turn part of our title for this meeting around to say that there is a Challenge to Government and how it organizes itself to do the job in responding to the Commission's report. An effective civilian agency seems to be needed for direction and funding and showing industry that it means "business". There is a great deal for Government to do to provide industry with the necessary incentives and favorable economic environment in many areas of oceanology.

Government initiative is needed in fisheries, in pollution, in shipping and shipbuilding, in research and development, in underwater search and rescue, in coastal and harbor development. Some progress has been made. We hope it continues and without undue delay.

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OCEANOGRAPHY AND NATIONAL DEFENSE

Proposals to Bar Arms from the Ocean Beds

The Russians have submitted a draft treaty at the disarmament conference currently underway in Geneva prohibiting the use for military purposes of the sea bed and the ocean floor and the sub-soil thereof beyond the 12-mile maritime zone of coastal states. Nuclear weapons or any types of weapons of mass destruction, military bases, structures, installations, fortifications or other objects of a military nature would be forbidden. Territorial waters would be excluded.

The United States, through a letter submitted by President Nixon to the conference, in its first item has proposed that an international agreement be worked out that would prohibit the emplacement of nulcear weapons or other weapons of mass destruction on the sea bed. In responding to the Russian proposal, Gerard C. Smith, Director of the U.S. Arms Control and Disarmament Agency, indicated that the U.S. would oppose the Soviet proposal to include in the ban, military bases, structures, installations, fortifications and other objects of a military nature either on the ocean floor or beneath the sea bed. There would be no ban on the operation of submarines in either proposal.

It is both significant and unusual that the Russian proposal is broader than the one from the U.S. and perhaps indicates that we have a greater expertise and technical competence in constructing such facilities underwater at the depths that would be involved than have the Russians. The U.S. reaction to the Russian proposals would seem to imply that we do plan to extend our defense facilities to our continental shelves off our coasts and beyond our own territorial waters. This development reinforces our conviction about the favorable outlook we foresee for marine construction. The Navy certainly represents a significant source of potential business in the construction of underwater facilities on our continental shelves.

Satellite Photo Reconnaissance of the Oceans and Land Areas

In our November, 1968 issue of this report, we noted that Admiral Rickover, the father of the nuclear submarine, had succeeded in convincing the Department of Defense that the Navy should proceed to build an experimental new nuclear-fired, electrically propelled silent submarine and also a prototype high speed attack submarine. The apparent reason for Admiral Rickover winning his battle recently became apparent in the course of an extraordinary American Broadcasting Company television program February 9, 1969. This program was the second in a series entitled "Man and His Universe" sponsored by the North American Rockwell Corporation. This instalment entitled "The View from Space" (copyright American Broadcasting Company - 1969), was highly significant for several reasons. The color photography of the earth and moon from Apollo 8 was extraordinarily beautiful. The program also gave a number of specific examples of how the nation has been benefiting from its space program. The solving of a particularly frustrating shrimp fishing problem through Gemini photography, in particular, was cited for one.

The program's outstanding contribution, however, was its revelation of the value of military and commercial satellite photo-reconnaissance. The program explicitly reviewed communication and weather satellites, and showed some actual sequences of recovery of film packages in mid-air which had been ejected on command from the Air Forces' Space and Missile Observation Satellite (SAMOS). As recently as last year even the use of the name of this satellite in print was discouraged. In the course of the program, the ABC television narrator, Mr. Jules Bergman, pointed out that both Russia and the United States have large and very active space reconnaissance programs with satellites that use both television and film cameras.

We launch our recon spacecraft into polar orbits so that Red China and Russia are visible beneath them in daylight hours every day. What they have discovered since we started launching them regularly in 1963 has saved America billions of dollars in unneeded armaments and possibly prevented a war based on miscalulation of enemy strength. These satellites first uncovered Russia's new nuclear-powered missile-equipped submarines which were subsequently closely watched. It was reported that one fantastic picture taken last year - none of them has ever been released and this one was not shown - spotted more Soviet nuclear submarines being built in one yard on the Baltic than were being built in all the American shipyards. This rang the alarm bell since it was realized that Russia had a submarine

that was faster and deeper diving than many of our nuclear submarines. This was discovered in time and continued aerial reconnaissance confirmed the situation and a program to develop faster deeper diving United States submarines has now begun.

The programs also showed some examples of photographs which approximated real reconnaissance pictures shot from aircraft and spacecraft. According to the narration, against the sun glitter on the ocean could be seen ships' wakes viewed from an airplane. The ships had long since gone but where two wakes came together a submarine and its tender had rendezvoused. By the use of infrared and other photographic devices it was revealed that the speed of these ships could be determined and whether or not they were nuclear powered. Finally, the program pointed out a statement of ex-President Johnson's in a little-noticed speech last year, in which he remarked that more than enough billions of dollars have been saved through satellite reconnaissance to pay for the entire military and civilian space programs. Incidentally, this is a striking example of the relation between space and the ocean and why the advanced technology companies of the aerospace and electronics companies are interested in oceanography. It is our understanding that this ABC-TV program is to be repeated April 7th at 7:30. We urge those of our clients who missed it on February 9th to watch for it again.

U.S.S. Dolphin (AGSS-555)

This new nuclear deep diving Navy submarine prototype has recently completed its design depth test dive which is thought to be about 6,000 feet. By the mid-1970's it is believed the Navy will have submarines capable of operating at such a greatly increased depth. The Thresher, it will be recalled, apparently collapsed at a depth of about 1,000 feet, while undergoing design depth test dives and subsequently sank to the bottom where it was found at 8,400 feet. Present high speed nuclear attack submarine hull profiles are patterned after that of the specially built diesel powered USS Albacore which was the prototype test unit in the 1950's for the optimum fully submerged and highly successful high speed hull. The Dolphin is to play the same role as a prototype for advanced deep diving nuclear powered submarines. It is more than just a research vessel, as it is designed and built to test deep ocean weapons and tactics to develop weapons capable of being fired to and from much greater depths than is possible with systems now operational.

THE RISING SOVIET SEA POWER

Dr. John J. Clark, Dean of the College of Business Administration, St. John's University, New York, in a prize essay appearing in the March edition of the U. S. Naval Institute Proceedings had the following to say about the emerging Soviet naval threat:

> " The single most ominous episode of contemporary history, largely underrated by West European states, is the gradual shift of emphasis by the Soviets to a maritime strategy. The Russian bear senses that in any struggle of global dimensions, control of the sea constitutes

the center of gravity. The bear also senses that if he is checked on land by alliances of independent states, the use of the ocean allows him to get behind his prey. Thus the Russian fleet has accomplished what the Red Army can not do, it has turned the NATO flank in the Mediterranean. The bear must surely now perceive that the Indian Ocean offers equally bright prospects. Conversely, a modern maritime stragegy widens the area of maneuver for the United States. Where land intervention in the Eurasian land mass is contemplated, gains and costs must be weighed. A maritime strategy will permit its possessor to intervene at a time and place of his choosing and to define the area of conflict in the most favorable terms....."

Secretary of Defense, Melvin R. Laird, is testifying before the Senate Foreign Relations Committee on the Non-Proliferation Treaty affecting nuclear weapons, reported that the Soviet Union is pursuing a crash program to build a fleet of ballistic missile submarines comparable to the U.S. Polaris submarine fleet. This could bring the Soviets to an equal status with the United States in missile firing submarines by about 1973-1974.

The U. S. Navy's most urgent problem is the development of its mastery of the oceans depth, so that it can at all times detect, locate, tract, identify, and if necessary, destroy this primary strategic threat. Former Defense Secretary, Clark M. Clifford, in the outgoing administration's final defense budget reported that the Russians had surpassed American intelligence estimates by moving from 250 ICBM's in mid-1966 to 900 by last September. They have now drawn about even with the American land based ICBM force at around 1,000. He also reported that the Russians had only about 45 Polaris type missiles compared to the 656 accounted for by U. S. Navy fleet of 41 feet ballistic missile submarines (each carries 16 missiles). Nevertheless, the Soviet submarine threat continues to grow and Mr. Clifford reported that this fact had led the Defense Department to a number of moves in the anti-submarine warfare field. For instance, last year's plan to cut back anti-submarine aircraft carriers from six to five has been scrapped, as was a plan to decrease the number of anti-submarine patrol aircraft.

More land-based Lockheed P-3C Orion patrol aircraft will be bought, and a new carrier-based ASW plane will also be procured. A team composed of Lockheed and LTV-Aerospace is presently competing against General Dynamics Corp. to be the procurement source for this new airplane presently designated VSX. It is anticipated that one of these companies will be selected as a procurement source by March 31st. Furthermore, Secretary MacNamara's old plan to limit to 69 the number of nuclear powered attack submarines to be used in combating the Soviet submarines has also been scrapped. Plans are being made to buy a number of new types of faster and quieter nuclear-powered submarines, the first three of which are proposed in the new fiscal 1970 defense budget. We reported on these new submarine types in the previous issue of this report.

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The major portion of the Soviet fleet threat is its 50 nuclear-powered submarines backed by another 300 conventional submarines. It should be remembered that Hitler only had a total of 55 conventional submarines at the start of World War II. The Russian surface fleet has become second only to the U. S. in size, and it includes 25 missile ships and over 100 destroyers, many of them gas turbine powered. It also has 300 minesweepers, 230 landing ships and 750 patrol craft. The latest worrisome additions are two 25,000 ton, 650 foot helicopter carriers, one of which is now based in the Mediterranean. Most of this fleet has been built in the past 20 years, whereas only one-third of American naval vessels are that young.

Russia's worldwide fleet of intelligence ships is almost as dangerous strategically as its warships, since these are the ones responsible for the surveillance of our surface fleet, including our FBM submarines. It is believed that Russia is turning out about 10 nuclear submarines each year. Because of the demonstrated technical capability of the Russians in space, rockets and missile building, it is highly probable that in four or five years, the Soviets can match or exceed our present fleet of 41 Polaris-type submarines with their 656 1500-mile range missiles. Such submarines could lie undetected off our coasts and reach any inland city in the United States with this missile. Until recently, our entire ballistic missile warning system has been oriented to the north over the Arctic. (We currently have no actual defense against ICBM's, such as the proposed Sentinel ABM system would provide). We are now becoming rapidly exposed to submarine-based ballistic missiles coming from the east, west and south. We believe this is the major reason why the Navy's oceanography budget, excluding procurement of weapons systems, accounts for slightly over half the present $500 million annual National Oceanographic Program Budget. It is for this reason that many of our investment recommendations in Oceanography in past issues of this report have been the high technology companies found among the aerospace, electronics, shipbuilding, computer and anti-submarine warfare equipment companies.

A nuclear attack submarine, such as we represented by the ill fated Scorpion which was recently found and photographed lying in 10,000 feet of water, is one of the most effective anti-submarine weapons we now have. Apparently, the Navy has decided to expand significantly its fleet of attack submarines. We would expect to see General Dynamics, for one, begin to see a resurgence in its nuclear submarine building. General Dynamics is already under contract for design work on the new silent submarine mentioned above. The Newport News Shipbuilding and Dry Dock Company, subsidiary of Tenneco, Inc., is designing the prototype of the "superfast" nuclear powered attack submarine.

Nuclear submarines have been developed and designed under the systems concept so highly developed by the aerospace industry. General Dynamics did the primary work. Later, companies such as Litton Industries established themselves in this business because it was a highly developed systems business, demanding advanced, integrated electronic and electro-mechanical equipment, guidance systems, computers and weapons systems. These are also designed and built by other aerospace companies, for example, North American Rockwell,

Sperry Rand, United Aircraft, Aerojet-General, etc. In effect, these submarines are highly-efficient machines, employing considerable automation. In the last five years, we have spent less than $50 million on research and development for sea lift and sea transport, while spending over a billion dollars for air lift and air transport. Systems equipment, made possible by the development of nuclear submarines, can be applied to surface ships--both military and merchant marine. In addition, we can automate this surface shipping to effect crew reduction, with increased efficiency.

With the U. S. merchant fleet deteriorating -- and, way down the totem pole compared to the merchant fleets of other nations, the country faces a tremendous need to modernize its surface Navy, as well as to strengthen its underseas fleet. We believe we are on the brink of an era of shipbuilding of very advanced and specialized vessels, both military and commercial, including surface effect ships, gas-turbine-powered ships, nuclear-powered destroyers, missile ships and specialized logistics ships. In fact, the fiscal 1970 defense budget, as submitted, contains $2. 4 billion for 19 new ships including a nuclear-powered carrier, three fast nuclear attack submarines, a nuclear-powered missile ship, five ultramodern destroyers, and 19 conversions, including six Polaris submarines to carry the new Poseidon missile, successor to the Polaris. The pressure is rising in Congress to start modernizing the Navy and the Merchant Marine.

UNDERWATER HABITATS

Sealab III

The tragic death of Berry Louis Cannon, a civilian electronics engineer from Panama City, Florida, last February 17th, while working on the continental shelf 600 feet beneath the Pacific Ocean on the first day of the Navy's scheduled but delayed 60-day "Man-in-the-Sea" experiment, received wide attention in the press. The Sealab III experiment to test a man's ability to live and work for long periods at great depths had reportedly been plagued with trouble for months. Back in November, the personnel transport capsule, used to transfer aquanauts to the undersea habitat from the surface under pressure, was accidentally flooded which forced a two-month delay in the placement of the Sealab on the sea bottom to commence the experiment.

Mr. Cannon apparently died of a cardiac arrest induced by carbon dionide poisoning from a faulty breathing apparatus which is now being investigated by the Navy. He had gone down to repair a leak of helium gas used in the breathing atmosphere inside the vessel. It was decided to raise the habitat to the surface, not because of Mr. Cannon s death, but because enough helium was not available on the site to keep up with the increasing rate of the leak which had reached some 10, 000 cubic feet per hour at the time of the decision to raise it. Failure to keep the vessel pressurized undoubtedly would have resulted in flooding and disastrous damage to the whole rig. According to the Navy, it may take three or four months

to repair and modify Sealab III and expects to restart the experiment in the late summer. Sealab III is part of the Man-in-the-Sea phase of the Navy Deep Submergence Systems Project established as a result of the nuclear submarine Thresher loss in 1965. Another part of the project, the Navy's Deep Submergence Search Vehicle now under development, has top priority in testing so that further delay of Sealab III could conceivably occur.

The Sealab III habitat was specifically designed, fabricated and outfitted by the Navy for use as a sea floor laboratory. Its structure is essentially the same as that of its successful predecessor, Sealab II, although it contains modifications reflecting the experience acquired in earlier ocean work. A 57-foot long 12-foot diameter cylinder accommodates five teams of aquanauts for successive 12-day periods during the 60-day experiment. The aquanauts will perform tasks in six general areas, namely, oceanography, engineering, construction, salvage, biology and human performance. Sealab III is supported on the surface by the "Elk River", a converted World War II landing ship which provides complete decompression facilities, personnel transfer to and from the habitat, physiological monitoring and medical facilities, storage of equipment and maintenance of communications, instrumentation and gas sampling lines.

The objective of the Sealab III program is to gain knowledge and "know how" pertinent to the adaptation of man to the deep sea environment at ambient pressure. The primary interest of the Defense Department and the Navy in the "Man-in-the-Sea" experiments is to provide a capability for rescue and salvage operations, maintenance of bottom-mounted equipment, use of the continental shelf for military operations associated with, for example, mine defense and amphibious assault. However, this program has vast potential secondary peaceful uses for the nation. Technology gained in the program will hasten to make possible exploitation of the world's continental shelves for food, minerals and recreation. By 1970, the U.S. Navy plans to have diver-aquanauts living in advanced sea habitations on the continental shelves for 30 days or more without coming to the surface. The depth capability of the aquanauts will ultimately be extended from the average 600-foot depths of the shelves down to the as yet unknown physiological limits of man. Forty aquanauts, five teams of eight men each, including civilian scientists, will occupy the underwater habitat alternately for 12-day periods for a total of 60 days. Commander M. Scott Carpenter, the former astronaut who was team leader for 30 days during the 1965 Sealab II operation, is serving as senior aquanaut directing the activities of the five team leaders, although he will no longer participate in actual diving because of medical considerations. A number of U.S. Navy activities as well as the Department of Interior's Bureau of Commercial Fisheries and the Philadelphia General Hospital are involved in developing the tasks the aquanauts will perform.

In carrying out the project's physical oceanography work, devices will be installed in the ocean floor including current meters, thermographs, a tide gauge, an underwater "weather station", temperature recorders, bio-luminescence meters, a radiance meter, and salinity meters. Aquanauts from the Bureau of Commercial Fisheries will conduct work in the areas of marine biology and ecology. Porpoises and sea lions will also be used as they were in Sealab II to demonstrate the feasibility of aiding lost aquanauts, delivering tools, messages and other objects.

The Geological Oceanography program will observe sedimentological processes. Current measurements and time-lapse photography will be used to support the sediment transport studies. Work in the engineering phase involves communications, evaluation of diving equipment and extensive engineering evaluation of the sea floor habitat and systems. The construction experiment will help determine the ability of divers to assemble structures on the ocean floor. Salvage techniques will be tested, such as a chemical bottom overlay spray to reduce bottom turbidity and salvage lift systems. Tools such as explosive cable cutters, stud drivers, and electric powered hand tools will be evaluated. Human performance will be measured during execution of various work in salvage operations to develop procedures and work doctrines. During the experiment, the aquanauts will be observed by a closed circuit television, monitored by open microphones and extensively interviewed. The living compartment is essentially a cylindrical pressure vessel 57 feet long by 12 feet in diameter. Two 8 X 12 foot square rooms are attached to the bottom of the hull. One serves as a diving station with diving lockers, diving gear, hot showers and an open hatch for access to the sea.

The other is an observation and storage compartment fitted with large portholes, a refrigerator-freezer unit and an emergency escape hatch. The living compartment is divided into a laboratory, galley and bunk room. Electric power, fresh water, communications, television links, and other life support needs are supplied through lines to the surface from the "Elk River" surface support vessel.

The "Elk River" is equipped with two deck compression chambers each designed to support four divers during the six hour decompression period needed to return saturated divers from the pressure found at 600 feet to normal atmospheric conditions. A pressurized elevator system known as the Personnel Transfer Capsule will transport divers from the ship to the bottom habitat. This capsule also mates with the deck decompression chambers so that at all times whether on deck, or at 600 feet, the aquanauts can be kept at pressures equivalent to the ambient ocean pressures at the bottom.

Tektite I

On February 15th, four aquanauts entered the water off Beehive Cove, St. John, Virgin Islands, and entered an underwater capsule moored 42 feet below the surface to begin living in it for two months - twice as long as man has dwelt submerged before. The long range purpose of this $2.5 million joint federal agency program is to open exploration and exploitation of the continental shelf. Unlike Sealab III, which is a Navy project, Tektite is non-military. Three of the four aquanauts are employees of the Bureau of Commercial Fisheries and one is with the United States Geological Survey.

The capsule was built by the Missile & Space Division of the General

Electric Company and is remarkably similar to the command and service module of the Apollo vehicle. It is composed of two connected vertical cylinders 18-feet high by 12-1/2 feet in diameter mounted on a rectangular base. Although the Navy's Seabees have been responsible for placement and support of the Tektite on the bottom, other federal agencies involved are: National Aeronautics and Space Administration, the Bureau of Commercial Fisheries, the National Park Service and the United States Geological Survey. The National Park Service is involved because the waters surrounding land on St. John make up a national land and underwater park. The four marine scientists will conduct extensive studies of marine life and geology and the men themselves will be subjects of intense physiological and psychological examination, as they live isolated from the surface under saturation diving conditions. General Electric is the prime contractor.

Some of the observations of the scientists will be of value to geologists in providing clues as to where to seek petroleum or other mineral deposits, and sonar will be tested for fishery applications as well as to determine the effectiveness for differentiating between fish species. Major emphasis of the ocean bottom studies will be on marine animal behavior and habitats as well as how these animals interact with their environment. Other studies will include marine geology, underwater mapping, and monitoring of various oceanographic phenomena.

Another major purpose is to determine how men function in prolonged isolation and confinement in an effort to adapt the knowledge through long duration space missions, such as the Manned Orbiting Laboratory (MOL), being planned by the Air Force and NASA. Both the Air Force and NASA in the future hope to be able to ferry replacement crews to orbiting vehicles in space, with smaller and less complicated and less expensive boosters. Spacecraft thus, permanent orbiting spacecraft may be used indefinitely rather than being discarded after each mission. The Navy is also interested because it is studying the feasibility of placing submarine detection stations along the continental shelf which could be either manned or periodically serviced by divers.

UNDERWATER RESEARCH AND WORK VEHICLES - RECENT DEVELOPMENTS

Heretofore, we have been referring to underwater manned vehicles as underwater research vehicles because they have been largely experimental or built as one-of-a-kind for a specific purpose in underwater research, exploration, or salvage. Few of these have been profitable for their builders, but many of them have recorded some extraordinary achievements and the development of new and more useful types seems to have accelerated. We are now beginning to see the appearance of some second generation manned submersibles which are capable of being put to work on a truly economic basis. These submersibles offer promise of quanity production, particularly for work on the continental shelf, in the offshore petroleum industry and in underwater search, exploration, as well as, pipeline and cable maintenance, salvage and etc. In past issues of this report, we have described how essentially research vessels performed some amazing feats when requisitioned for the search for the atomic bomb off the coast of Spain and to search for the U. S. Navy submarine, Thresher. We believe the following items about what we consider second generation or working submersibles should be of significant interest to

investors.

Lockheed Aircraft Corporation - In January, Lockheed's "Deep Quest" located and positively indentified visually, through ports, the tail section of the Scandinavian DC-8 jet airliner that crashed January 13th in Santa Monica Bay, six miles from the Los Angeles Airport in 325 feet of water. On February 5th, it was reported that the wreckage of a United Airlines Boeing 727, which had crashed into the sea off Los Angeles on January 18th, had been found 11 miles offshore, scattered around on the ocean floor in 924 feet of water. All 38 persons aboard died in this accident which occurred shortly after takeoff. United Airlines chartered the Lockheed Missiles & Space Company's "Deep Quest" submersible in an effort to recover the flight data and voice recorders from which it might be possible to determine the cause of this accident. On February 28th, the cockpit voice recorder was recovered and on March 4th the flight recorder was recovered by a team working from the "Deep Quest". This submersible also found and assisted in the raising of all three engines of the 727. "Deep Quest" received Navy safety certification late last fall, when it was successfully tested to 8,050 feet.

Westinghouse Electric Corporation - Scientists from the Westinghouse Ocean Research Laboratory have been diving in the Santa Barbara Channel in the company's "Deep Star 4000" to study the status of sea life as a result of the recent oil spillage from an offshore oil rig there. They will continue to monitor the area periodically to determine any changes, other than natural changes, that may have been caused by the oil slick over a long period of time.

General Dynamics Corporation - Last December, General Dynamics launched "Sea Cliff" and "Turtle", identical deep diving submarines built by the company's Electric Boat Division. Raadm. Thomas B. Owen, Chief of Naval Research, said at the launching ceremonies that these vessels will enable the Navy to investigate 16% of the ocean floor, a portion equivalent in size to the surface of the moon. He also indicated that "Sea Cliff" would be used in an attempt to raise the research submarine "Alvin" which sank in 5,000 feet of water south of Cape Cod last October. We reported on this incident in our November 1968 report. "Turtle" will be assigned to the Atlantic Underwater Test and Evaluation Center (AUTEC) in the Bahamas for the purpose of maintaining the underwater components of the AUTEC range including miles of cable, some of which lie at depths of 6,500 feet.

On January 25, 1969, the world's first nuclear-powered research submarine, the NR-1, was launched for the Navy. This vessel is equipped with rollers to let it ride on the ocean floor and mechanical arms to pick up objects and perform useful work. It will demonstrate the feasibility of nuclear propulsion in a small vehicle and the ability to perform a variety of ocean engineering and military tasks. Until the advent of NR-1 all deep submergence vehicles have been extremely limited in operations in endurance and range by the fact that they have been powered by batteries. Like a nuclear-powered Navy submarine, the propulsion and auxiliary power source for NR-1 is, for all practical purposes, unlimited. She can stay down as long as on-board food and supplies hold out. The 140-foot 400-ton boat will be manned by a crew of five navy men and two scientists. Vice Admiral Hyman G.

Rickover, the Navy's nuclear propulsion expert, has said that this $67.5-million vessel's depth capability (which is classified) is equivalent to that of exploring an area several times the area of the United States. He believes that a tremendous potential discovery by the NR-1 should keep the Navy busy for a long, long time.

Grumman Aircraft Engineering Corporation - We recently observed Grumman's PX-15 "Ben Franklin" deep diving research vessel undergoing tests at its base in West Palm Beach. Since then it has successfully been tested down to 2,000 feet. Sometime this year, the "Ben Franklin" is expected to drift a thousand feet down in the Gulfstream from Palm Beach to Cape Cod with a crew of six. The "Ben Franklin" was built to demonstrate Grumman's capability and establish a reputation for reliable underwater vehicles in the same way that its reputation for reliable aircraft and space vehicles has been so well established. The Navy is interested in it for accurate bottom profiling surveys in order to determine where submarines could hide at considerable depth. The Navy is also interested because this vessel offers the first opportunity for extended submerged surveys, as is NASA because it provides an opportunity to study the problems of living aboard a sealed vessel for long periods of time which many will be required to do in future manned space flights. The oil and gas company pipelines are also interested because the "Ben Franklin" could perform long distance continuous pipeline surveys for which it is felt there will be a large market. Finding and preventing one potential pipeline break or pipeline foundation washout, according to Grumman, can more than pay for the cost of such a vehicle.

"OCEANOLOGY INTERNATIONAL '69"

In order to keep the United States Oceanographic program in proper perspective, a brief review of "Oceanology International '69", a joint ocean technology conference and exhibit held in Brighton, England, on February 17-21, 1969, as reported by Ocean Science News for March 7th, seems relevant. Well over 2,000 people from 32 countries registered, considerably more than expected. Every session of the technical meetings apparently was oversubscribed. Papers from over a dozen countries were read and some four volumes of preprints of the papers totaling over 800 legal size single spaced pages were submitted. In reviewing the papers, Ocean Science News reports that although the United States is certainly the most active and advanced nation in terms of effort, technological development and activity in oceanology, there are other nations in the world whose ocean interests are mounting and who are doing some things better than the United States. It might be said that an international oceanographic race is developing. There were 34 U.S. exhibitors among the 200 total. Russia was strongly represented and intent on establishing sales outlets for its oceanographic instrumentation. So were the Germans, Japanese and French, and of course the British. U.S. companies reportedly made over $1 million in sales on the floor of the exhibit hall with another $5 million in prospect over the following 30 days. This was primarily a technology rather than a science meeting and was well publicized and promoted in advance.

The Soviet delegate announced his nation's intention to double the size of

its ocean program in a few years. The U.S. representative, Dr. Richard Gyer, Vice-Chairman of the U.S. Marine Sciences Commission, reviewed the Commission's recently released report. Senator Claiborne Pell, (R.I.) Chairman of the Senate Sub-Committee and a member of the Foreign Relations Committee, pleaded for international cooperation in ocean space to prevent using the ocean bottom for the emplacement of advanced weapons. Sir John Foster, leader of the British group for world government, agreeing with Senator Pell that there should be international control over the seabed, proposed that licensing of its use should be controlled by some worldwide organization rather than governments. In general the papers were of good quality and many of them have been widely reported in the press.

PETROLEUM OFFSHORE

Recent Court Decisions

The World Court in The Hague has recently ruled that the equidistance principle of determining rights to the Continental Shelf for countries facing each other, as in the North Sea, is not necessarily a rule of customary international law, despite its adoption in the United Nations Convention on the Continental Shelf. It rather establishes that such offshore boundaries should be negotiated in accordance with equitable principles. Germany, which did not sign the Convention, has claimed that it should be entitled to more than the 8,900 square miles of Continental Shelf in the North Sea. Neighboring Denmark and The Netherlands received some 23,200 square miles, because their coast lines are convex rather than concave as is the case in Germany, which feels it should receive a larger portion of the Continental Shelf.

The Court set out certain guidelines to be followed in future negotiations between these countries in establishing exact boundaries, namely general configuration of the coast, physical and geological structures, natural resources of the area involved and regard for the length of each party's coastline and existing offshore boundaries.

The effect of this ruling could cause disputes between countries in other parts of the world, especially in the Middle and Far East. Undoubtedly, this will be taken into consideration during the forthcoming discussions and negotiations regarding any amendments which may be made to the United Nations Convention regarding the Continental Shelf. Petroleum companies would naturally be inclined to avoid exploration and development of areas which might be in dispute.

The U.S. Supreme Court has just issued a ruling in the case of Louisiana's claim to the Continental Shelf in the Gulf of Mexico that will give the Federal Government some 75% of the contested area in Zones 2 and 3. A special master will be appointed to determine the actual seaward limit of the inward waters from which the 3 miles seaward are to be measured. This line is to be drawn in accordance with the principles of the Convention on the Territorial Sea and Tributary Zones. It endorsed the principle of an ambulatory coastline to determine where the state's starting point should be.

In the Texas ruling, the Court also defined the coastline as the modern ambulatory coastline. It pointed out that if any alleged inequitable resolutions or detriments to orderly mineral development were to follow from this ruling, Congress could provide relief.

Thus, further delay could be anticipated before the exact area of the Continental Shelf in the Gulf of Mexico, over which Louisiana and Texas have jurisdiction, is delineated. The substantial funds being held in escrow, now over $1 billion, will continue to increase.

Exploration and Production

While the problems of working in the offshore area are still numerous, the advances in technology which have occurred over the past several years, have not been remarkable, and amply demonstrate what can occur when thought and ingenuity are brought to bear on a problem. The discoveries to date in the offshore area, even considering the disaster offshore Santa Barbara, continue to provide us with a great deal of enthusiasm for the rapid growth which we foresee in the offshore petroleum industry. Major onshore discoveries like those on the North Slope of Alaska and in the foreign sectors, such as the prolific Libyan wells, do not diminish our expectationsfor the offshore area. Demand for petroleum in the future is such that all the reserves will be needed. Our enthusiasm, naturally, spreads to the services provided by the drilling contractors and equipment manufacturers who will stand to benefit significantly from this increasing offshore participation. In fact, Shell Oil and Continental Oil direct more than 60% of their total exploratory budgets to the offshore area. Postponement of offshore lease sales may well result in increased exploration and development of existing leased acreage, as the oil companies would have more money this year for operations and less needed for bonuses. The offshore service and manufacturing companies would be the obvious beneficiaries.

Over the past year, new offshore production commenced in many different areas, including Iran's giant Sassan Field and offshore Cabinda where Gulf Oil will be producing about 40,000 B/D in 1969. Initial discoveries included the first successes in the Norwegian and Dutch sectors of the North Sea, offshore Brazil and off the northwestern coast of Australia. About 12 additional countries will record initial exploratory efforts off their coasts in 1969. They are centered in the African and Far East countries.

1. Domestic Offshore

Two important lease sales, one offshore Texas and the other offshore California, occurred in 1968. In May of last year, the industry spent $600 million to bid on 141 tracts offshore Texas and $603 million for acreage offshore California in the Santa Barbara Channel. These two highly distinct areas have turned out to be a mixed blessing, so far, for the industry.The acreage offshore California is, for the most part, in deep water and involves highly faulted structures and complex geology; offshore Texas, the water is generally shallow and the geological problems are miniscule when placed in perspective with some other areas.

The Santa Barbara Channel has been, for the most part, a disappointment to the industry. Up until the time of the recent disaster offshore Santa Barbara, only three announced discoveries had been made with a possibility of two additional. One was by Union Oil and its three partners, Gulf, Mobil and Texaco, each with a 25% interest in Block 402. The second by the Sun Oil Group (Sun Oil, Marathon, Superior Oil and Sunray DX Oil, which was recently merged into Sun) in adjoining Block 401, and the third by Humble Oil (Standard Oil of N. J.) in Block 342. In addition to these three announced discoveries, there is a possibility of two additional ones although no firm announcement has been made so far. Also, three active tests were being drilled when the Federal Government announced a suspension of drilling because of the oil spill in the Channel. But more importantly, there have been 31 dry holes or abandoned wells drilled so far in the Channel.

Most of the drilling results on acreage leased in the offshore Texas sale have been kept secret due to a substantial amount of acreage which is still unleased in the nearby vicinity. There have been two known discoveries and a possibility of about five additional ones. Firm discoveries have been announced by Texaco, the highest bidder in the Texas sale, and by the Alamos Group, a six company consortium led by Sun Oil, which received the greatest amount of acreage in this sale.

The Texas offshore lease sale benefited the contract drillers who had idle shallow water equipment. The average offshore Texas water depth is only about 80 feet, with the deepest portion being about 120 feet. The SLAM Group (Signal, Louisiana Land and Exploration, Amerada Petroleum and Marathon) recently set a bid record of $94.2 million for a 3,400-acre drainage block which adjoins other acreage held by the same group. The reserves in this block are apparently large. Development of the Block will commence shortly and add importantly to 1970 production for these companies. In the Santa Barbara Channel, however, water depths extend from 200 feet to 1,600 feet, even though the farthest acreage is only 15 miles from the coast. This is due to the small continental shelf which exists off the West Coast. The Santa Barbara accident, in which some 6,000 barrels of oil floated into Pacific waters from the initial leak, is covered in another section of this report.

It appears that offshore Louisiana acreage, still has the most potential left. A vast assortment of pipelines criss-cross Louisiana's offshore waters and numerous development platforms dot the area. Platform and pipeline construction is continuing at a high pace in order to bring the large gas and oil reserves to market. A substantial portion of the development work presently underway in this acreage resulted from the 1967 offshore Louisiana lease sale which amply demonstrates that if reserves are found in commercial quantities, a minimum time is needed to bring these reserves to market. Discoveries have been made by a vast assortment of individual operators and groups. Over 25 good discoveries have been made so far on acreage leased in the 1967 Louisiana offshore sale.

Alaska is quickly becoming a major source of domestic oil reserves. While the focus is on the two North Slope discoveries of 1968, other areas appear good. A substantial amount of production is already coming from the Cook Inlet area in southern Alaska. Vast amounts of the State's offshore acreage are frozen-out

for the better portion of the year; Alaska has more Continental Shelf off its coasts than the rest of the United States, excluding Hawaii.

It appears that lease sales originally scheduled for the latter part of 1969 in the Gulf of Alaska and Bristol Bay may be deferred until 1970, because of the Interior Department's suspension of bid requests for new offshore leases. Once more definite rules have been laid down for drilling in offshore areas, we believe that these lease sales will be rescheduled. Because of difficult year-round working conditions, a hiatus of only a few months in studying the Alaskan acreage coming up for bid would defer a lease sale offshore Alaska for about a year. While the cost of drilling in the Alaskan water is approximately five times that of drilling in the Gulf Coast, the possibility of large structures existing in the offshore area is quite high, as the Cook Inlet has proven out. Even the North Slope, which is so far primarily a landplay, adjoins the coast; the initial discovery well was only seven miles from the sea. In fact, General American Oil holds two leases which are seven miles away from the original Atlantic-Jersey discovery well. These two leases are 85% offshore. In future years, we expect that advances in the state of the art will develop so that petroleum can be produced from areas in which the ice forms a 25-foot thickness, with ridges extending to 75 feet during the mid-winter months.

2. Other Western Hemisphere

Offshore areas in the Western Hemisphere are receiving more attention. Exploratory and seismic efforts are being conducted off no less than 18 Central and South American countries. New petroleum laws in various nations, especially Argentina, are bringing seismic crews back into an area which once was one of the most promising in the Western Hemisphere. But while Argentina, under a new government, is now spurring the development of its offshore provinces, the Peruvian Government for one, is creating a cloud over Western Hemisphere oil exploration. Concessions have recently been awarded offshore Peru to Texaco, Gulf and Occidental Petroleum, and Belco Petroleum is already a producer in Peruvian waters. But the seizure by the Peruvian Government of Standard Oil of New Jersey's onshore Parinas Field, which was the result of a dispute of many year's standing, leaves that country in somewhat of a grey area. Acreage off some Central American countries is now, however, being explored more actively, especially Nicaragua, Honduras and the Islands of Trinidad and Jamaica.

Drilling in the Canadian Arctic is starting with the Panarctic Group (45% owned by the Canadian Government and the balance by 19 Canadian companies and Barber Oil) putting down its initial well on Melville Island. A second well is slated for April 1969. Sun Oil and Global Marine will conduct a magnetometer program this summer on a portion of 6 million Canadian Arctic acres, as will Pacific Petroleums on its vast Beaufort Sea acreage. If initial drilling in the Canadian Arctic by Panarctic proves favorable, this area should receive much more interest over the course of the next several years. Hudson Bay and the east and west coasts of Canada will also continue to be areas of intense activity.

3. The Near East

One of the hottest areas this year and next will be offshore Indonesia where Sinclair Oil (now a part of Atlantic Richfield) has reported an apparent discovery on a large offshore Block. The Iiapco Company, which is 100%-owned by Natomas, has a 36% interest, and Atlantic has 46%. Atlantic, the operator, is continuing to drill at an accelerated pace. In nearby Sumatra, Asamara holds 60% of a contract operation covering 1.5 million acres which entitles it to 40% of the production proceeds. Rumors continue to persist, and the price of Asamara's stock reflects this speculation, that Japan Petroleum Company has made an excellent discovery on acreage which borders on Asamara's. In nearby Papua, Phillips Petroleum has confirmed a strike of nearly 33,000 mcf/d of gas and 2,500 b/d of condensate. While drilling in this area has also yielded numerous dry holes, the amount of condensate in this, Phillips' second discovery well, is highly encouraging. Phillips is the operator for a five company group (including Superior Oil, Canadian Superior, Sun DX division and Atlantic Richfield) and is already proceeding on drilling a third well. Australia is an excellent, politically stable captive market for reserves discovered in Papua, a possession of this country. Promising oil and gas finds are still being made offshore Australia and it now appears that the nation will be self-sufficient in petroleum in only a few years. Petroleum laws are being drawn up by the Australian Government to provide for the export of crude.

An improved political climate in Thailand is attracting a number of companies to conduct seismic operations in the Gulf of Thailand. Exploratory drilling operations have also commenced offshore Brunei by Ashland Oil and offshore Pakistan by the Royal Dutch-Shell Group. Numerous companies are also drilling offshore New Zealand's extensive Continental Shelf, hoping to find large Australian-type structures there.

4. Africa

Due to the continued closure of the Suez Canal and the remote possibility of its opening in the near future, offshore African provinces have been receiving increased attention, especially off the western coast of the Continent. Operations offshore Nigeria are accelerating as conditions improve and the civil war diminishes. In neighboring Gabon, Union Oil is conducting an extensive seismic program. The possibilities of Nigerian-type structures off Gabon provides a good climate for the operators. Gulf Oil is already developing its large reserves offshore Cabinda. The first discovery, after several tries, offshore South Africa has recently been made by the Superior Oil Group. The waters surrounding South Africa, because of proximity to two oceans and dangerous currents, is an extremely hazardous working area and drilling can be quite treacherous.

DRILLING CONTRACTORS AND EQUIPMENT MANUFACTURERS

Hayden, Stone's Petroleum Offshore Contractors Index

The securities of most offshore drilling companies have been the subject of a great deal of selling pressure over the past two months. In some cases, the recent weakness in certain securities was warranted; in other instances, we feel it has created unusual values. At year-end 1968, the Hayden, Stone Petroleum Offshore Contractors Index stood at 138.18, up a hardy 19.7% for the year, more than double the 8.7% gain for the S & P 425 Industrials. The Index has slipped from 138.18 to 121.10 for a 12.4% drop between January 1st and March 1st of this year, a more rapid decline than the 4.0% posted for the Industrials Index.

We expect the Hayden, Stone Petroleum Offshore Contractors Index will stay around its present level of 121 for a short while longer, but we forecast that within a month or so it will begin rising. We expect our Index to out-perform the S & P 425 Industrials and the S & P Oil Composite Indices for 1969. We certainly do not see the boom in offshore drilling stocks ebbing, although their full potential may not be realized until the stock market as a whole takes on a more positive tone. Our target for the Index in 1969 is 135, or about 12% above the present level.

STOCK PRICE INDICES

	1/3/68	12/31/68	% Change 1/3/68-12/31/68	3/5/69	% Change 12/31/68-3/5/69
Hayden, Stone's Petroleum Offshore Contractors	115.43	138.18	+19.7%	121.10	-12.4%
Standard & Poor's 425 Industrials	104.09	113.02	+ 8.6%	108.51	- 4.0%
Standard & Poor's Oil Composite	130.24	152.23	+16.9%	146.65	- 3.7%

Offshore Petroleum Technology

Advances in offshore technology are continuing to develop. Especially significant is the design of offshore platforms which are capable of working in various worldwide locations and at different water depths. A vivid example of this is the contract recently awarded by Kerr McGee to a Japanese shipyard for the construction of the Transworld Rig 61. The rig is a combination self-elevating drillship, and a semi-submersible. The rig can move to a new drilling site like any other drillship would, which provides for greater speed and more efficient towing. Once on location, the legs are jacked up and the rig takes on the characteristics of a semi-submersible, capable of drilling in 600 feet of water. Another example of flexibility in rig design is Santa Fe International's Mariner I, which is narrow enough to traverse the Panama Canal, rather than having to take the long route around the Cape from one ocean to the other. This eliminates a significant loss of nonproductive time and cost. Bethlehem Steel Shipbuilding is working on the

design of a rig which could also traverse the narrow Canal. Upon its arrival at the chosen drilling site, four pontoon-type legs would swing-out and provide for even greater stability in rough areas.

Other companies are redesigning existing rigs. Zapata Norness accomplished this with a third of its fleet last year and permitted all three of the rigs which were involved to work in greater water depths. The usual procedure chosen is to add members to the existing legs, replacing the legs with longer ones or converting a bottom-supported vessel to one which is buoyant in the water, thereby permitting it to operate in greater depths. While the cost of these improvements can exceed 50% of the rig's value, the revenues which can accrue from the rig's increased daily working rate as well as its being able to obtain a greater utilization factor, can more than pay for the improvements.

Not only are the rigs changing, but so is the equipment. Improved drawworks, better air and hydraulic systems, and more efficient cranes are materially upgrading their use, value, and efficiency. Further advances are expected in the future as the need for flexible, tough and reliable equipment which can work in any area, ranging from the Arctic cold to the Equitorial heat, increases. Improved pumping systems for deeper wells and more reliable blowout preventers to insure the safety of man and machine are being developed. Lighter weight turbine engines are being improved so that they can be made capable of jobs where the horsepower requirement is greater than the capabilities of today's existing models.

But while exploratory rigs are being constructed with increasing flexibility, production platforms are being geared to incorporate the latest designs for the specific area in which they will work. Union Oil's monopod platform in ice-swept Cook Inlet, helicopter transported rigs, rigs which are drilling on a 40 degree angle into shallow offshore sands near Peru, and special purpose rigs for use on the THUMS project, a series of man-made islands offshore California are but a few examples.

We expect that within the next several years one or more of several deep-water production systems will be placed in operation. Such Systems have already been designed by:

1. Mobil Oil - North American Rockwell;
2. Fluor Corporation (Western Offshore Division)
3. Compagnie Francaise des Petroles (CFP) - Westinghouse Electric with two separate systems.

Offshore deep-water tanker terminals, including underwater storage systems, will be used with greater frequency in the future. Some are already being placed into service. Companies involved include:

1. Gulf Oil-three offshore loading stations; one in Bantry Bay, Ireland, the second in the Persian Gulf and one in Nova Scotia, with several more planned throughout the world, including one at Okinawa.

2. Continental Oil - an inverted funnel storage facility being installed offshore Dubai. Built by Chicago Bridge & Iron.

3. Santa Fe International - prestressed concrete cylinders laid on the ocean floor.

4. Bethlehem Steel - bottom supported, large diameter bottles. A second innovation is specifically designed for non-water, soluble refined products storage.

Standard Oil (New Jersey) will conduct a research program this summer for the purpose of testing a new type of icebreaking device and to ply the fabled Northwest Passage. The S.S. Manhattan, the largest U.S. merchant marine ship, is being outfitted for this journey. An icebreaker designed at The Massachusetts Institute of Technology is being attached; the MIT device lifts the ship over the ice and then proceeds to crash down on the ice floes. Present icebreaking devices merely attempt to crash through the ice, head-on. We believe that the MIT breaker, as well as the recently developed Canadian Alexbow system, in which the breaking prow lifts the ice from underneath through the natural buoyancy of the ship, will be able to penetrate thicker ice masses than conventional icebreaking systems. If the results of this summer's program prove favorable, it would open a channel for North Slope crude to the Eastern Seaboard. Standard Oil (New Jersey) and British Petroleum, who recently acquired 9,700 Sinclair service stations from Maine to Florida would benefit most by the opening of the Northwest Passage. Longer range, huge submarine tankers which could deliver North Slope and Canadian Arctic crude to Europe via an undersea North Pole route, are being investigated.

Drilling in offshore areas is creating a paradox. On the one hand, it is bound to become more expensive. On the other, costs of associated drilling operations are decreasing materially. The science of drilling for oil offshore is still in its infancy and there will certainly be tremendous breakthroughs in the future, both in terms of available technology and in lowering the costs per well drilled.

Santa Barbara Oil Spill

The recent blowout of a well offshore California in the Santa Barbara Channel was a rare, but most unfortunate accident. It was reported that this was the first occurrence of a wild oil well causing mass pollution problems since offshore California drilling began some sixty years ago. As a result, stringent new rules have currently been issued in order to obviate, or at least,lessen the chances of this situation recurring. Methods are needed to cope with the special problems associated with the complex faulting in the Channel. Furthermore, offshore drilling regulations have not been updated in many years. These new rules encompass the following provisions:

1. More frequent testing of blowout preventors.

2. The quick availability of skimming apparatus, anti-pollution equipment, and booms, in the event of an emergency.

3. More rigid drilling procedures, especially in cementing, mud handling, and completion techniques.

4. Additional installation of well casing, sometimes including as many as four strings.

It appears likely that no further lease sales will be made in the Santa Barbara Channel and that drilling operations may be terminated, at least in certain sections of it. Results to date have been disappointing anyhow. The Interior Department has estimated that if it were to order drilling operations in federal waters in the Channel to be stopped permanently that it would cost the Federal Government maybe as much as a billion dollars or more in return of bonuses, prospective royalties and other expenses incurred by the oil companies which have already been awarded leases. We would expect, nevertheless, that offshore operations would be permitted to continue in other areas of the West Coast and for lease sales to be resumed in the Gulf of Mexico and Alaska as soon as the new regulations have been issued. Programs of this nature, no doubt, will increase the operators' costs, but some costs are decreasing. Certain types of seismic work in the Gulf of Mexico now cost as little as $0.01 a shot, whereas only several years ago the cost was on the order of $0.20 a shot.

One group of companies will benefit from tighter rules. These are the companies who supply the casing, the drilling muds, the tubing and the cementing services. Although there are a vast assortment of such firms, some of the important ones include Halliburton, Dresser and Fluor's Republic Supply Company division.

Robert L. Clark
Stuart H. Clement, Jr. C.F.A.

Mr. LENNON. Any other questions?

Mr. CLARK. Thank you very much, sir.

Could I just make one further comment about a point that you raised regarding the NACO and NOAA being independent of each other and on the same level?

The point that I perhaps was taking exception to in the Commission's report was the proposed dependence of the committee on NOAA, the staff and certain administrative functions. It might be better to have the committee stand on its own and not be dependent.

Mr. LENNON. You are saying that the committee ought to be independent in the sense that it have its own staff funded by the Federal Government?

Mr. CLARK. Right.

Mr. LENNON. Just as the National Commission which brought this report had a budget under which it had its own staff.

Mr. CLARK. Yes.

Mr. LENNON. Although they occasionally borrowed from the staff of the National Science Council.

I certainly agree with you.

Mr. CLARK. And I think that this is, perhaps, an important point of deviation from the Commission's report insofar as I would like to testify here before you.

Mr. LENNON. That is a point we can clear up.

I agree with you, it should not be dependent on the staff of NOAA. It should have an independent staff so that they can make independent determination and judgment and recommend without influence from any Government agency.

Mr. CLARK. Yes.

Mr. LENNON. Mr. Counsel.

Mr. DREWRY. Mr. Chairman, there was mention of the amounts of money involved in, I believe you mentioned the figure, in the oil industry last year——

Mr. LENNON. You can correct that figure because I have taken it off the top of my head.

Mr. DREWRY. The table appears on page 123 of the Commission's report and shows that for 1968 the estimate of domestic offshore expenditures for private industry was $2,350 million, and the cumulative amount through 1968, which I suppose goes back to the time when the leasing first began, was $12,750 million.

Mr. Chairman, I think it might be appropriate to insert this table in the record at this point.

Mr. LENNON. I think it is appropriate in light of the very inquisitive question made by the gentleman from New York related to the rejection of such a program in light of our problems in our cities.

I think the basic difference between the space program is that so far we have not perceived, have not yet realized, any financial reward to the Federal Government as we have with funds spent in the other areas. Every nickel which has been spent has been spent by the Federal Government for which we have had no return except for employment in these various companies which are building hardware for the programs, which means a great deal to our country.

Here we have the potential of actually bringing wealth to the Federal Government from the oceans and seas of the world. I do think

that this is a criterion on which this program will ultimately be accepted with the help of our fine friends of the news media if they tell the story because this potential is there.

I will ask unanimous consent that there appear in the record at the request of counsel the table which he referred to.

(The table follows:)

TABLE 4-2.—DOMESTIC OFFSHORE EXPENDITURES

[In billions of dollars]

	1968 (estimate)	Cumulative (through 1968)
Lease bonus and rental payments	1.25	4.00
Royalty payments	.25	1.85
Seismic gravity and magnetic surveys	.10	1.10
Drilling and completing wells	.35	3.10
Platforms, production facilities, and pipelines	.25	1.85
Operating costs	.15	.85
Total	2.35	12.75

Source: Richard J. Howe (Esso Production Research Co.), "Petroleum Operation in the Sea—1980 and Beyond," Ocean Industry, August 1968, p. 29.

Mr. CLARK. Might I just please come back to the Representative from New York's very salient question about how do you sell the program to the public. This, I think, is vital.

First of all, we have said money coming from the Government is having a catalytic effect. This is a concept that maybe we don't sell it in those words but it has, I think, a generating effect on industry.

Just as you said, sir, the space program is all out go and this is going to bring a lot of income and benefit to industry and to the people and I think, sir, that the marine recreational field, the work along the coast, the conservation, the improvement of our beaches and our coastal resources which have become so depressed and depredated in many areas, that this is something that one can go out and certainly I would think get votes on if you can improve a beach and improve facilities so that the people can enjoy the recreation of a weekend that they perhaps could not have before.

Mr. BIAGGI. I do not quarrel with that, Mr. Clark, but the real thrust of my question was directed at the problem of selling it.

Mr. CLARK. I would, if I may, sir, just clarify the FPC discussion that we have had.

I am not against FPC. I am for the most economical source of protein. And I am in favor of having an experimental program in this area, and I am very much aware of the malnutrition not only in our own country but in the world.

Mr. PELLY. Incidentally, it is interesting to note that the space program has been represented as having a lot of sex appeal as far as selling it to the public is concerned despite the fact that the New York Times has been trying to get Congress to reduce it all the time, whereas on the other hand we have a little trouble with funding marine recreation and some of the other programs which are more basic to people's needs, and I am sure the Times has been for them 100 percent, increasingly so.

It indicates that the public is not necessarily influenced by the New York Times.

In your colloquy with Chairman Lennon, you expressed some concern regarding the dependence of the committee and NOAA on one staff.

On page 246—and I will say this for the record because the chairman thought we should amplify it—in the second paragraph, there is a reference to what I think you took exception and that is that the committee should be administratively attached to NOAA.

Mr. CLARK. Yes, sir. That is the section that I would take exception to; yes. I appreciate your referring specifically to it.

Mr. PELLY. Your exception does then refer to the fact that the recommendation on page 246 suggests that the committee should be administratively attached to NOAA.

One witness today has indicated that it should be independent.

Mr. LENNON. I think in the light of what you have said, and I agree with you in the light of this recommendation, that the time may come when we have to bring back Dr. Stratton at least to find out definitely what he means by that being administratively attached. There could be a dialog or rapport with all nations but if it is going to be a national committee, advisory committee, it should not be attached to a Government agency in such a way that it has to rely upon that agency to make its decisions.

Mr. CLARK. It perhaps should be as independent as the Commission was.

Mr. LENNON. It should be more comparable to the Commission we had.

Mr. CLARK. Yes, sir.

Mr. LENNON. Thank you very much for your presentation and attendance.

It is the intention of the committee to continue its hearings next Tuesday morning, June 3, at which time we hope to have and will have Dr. Bruce Halstead, director of the World Life Research Institute of Colton, Calif., and Dr. William J. Hargis, Jr., director of the Virginia Institute of Marine Science, Gloucester Point, Va., representing the Commonwealth of Virginia, Virginia Institute of Marine Science, and the Council of Maritime States, Commonwealths, and Territories.

I would like to ask the staff, if they would, to go into executive session if we find time after these witnesses to discuss our program and our hearings for the future. I understand that there are some 80-odd persons who have indicated a desire to come before the committee and testify. We have to resolve when we shall hear them and to what extent we will be able to hear all of them, if at all.

Thank you very much.

That concludes the meeting this morning.

Mr. CLARK. Thank you, Mr. Chairman.

(Whereupon, at 12:20 p.m., the subcommittee recessed, to reconvene at 10 a.m., Tuesday, June 3, 1969.)

NATIONAL OCEANOGRAPHIC PROGRAM—1969

TUESDAY, JUNE 3, 1969

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 10:15 a.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Paul G. Rogers presiding.

Mr. ROGERS. The subcommittee will come to order, please.

Our first witness today is Dr. William J. Hargis, Jr., who is director of the Virginia Institute of Marine Sciences, and he is representing the Commonwealth of Virginia, the Virginia Institute of Marine Science, and the Council of Maritime States, Commonwealths, and Territories.

Dr. Hargis, it is a pleasure for the committee to have you and we will be delighted to receive your testimony. First the gentleman from Virginia may wish to make some remarks.

Mr. DOWNING. Thank you, Mr. Chairman.

The witness, of course, is a constituent of mine and I think one of the most knowledgeable people in the field of oceanography, that I know of anyway. I am so pleased that he is up here before this committee on this important subject.

I think that in the days to come you will see more of Dr. Hargis on a national scale. I hope it is not detrimental to Virginia, but I am sure that that will be true. It is a pleasure to have you, Dr. Hargis.

(The biography of Dr. Hargis follows:)

BIOGRAPHICAL SKETCH

William J. Hargis, Jr., Director.
Virginia Institute of Marine Science.
Gloucester Point, Virginia.
Dean, School of Marine Science, The College of William and Mary.
Chairman, Department of Marine Science, The University of Virginia.
Date and Place of Birth:
    November 24, 1923
    Lebanon, Russell County, Virginia
Parents:
    William Jennings Hargis, Sr. (dec.) of Lebanon, Virginia
    Addie Corbett Harris of Tangier Island, Virginia
Marital Status:
    Married—Wife, former Dolores Elsie Martin of Oxford, Maryland
    Four Children (Laura Anne, Thomas Jonathan, Susan Combs and Emily Martin)
Academic Training:
    University of Richmond, A.B., 1950.
    University of Richmond, M.A., 1951.
    Florida State University, Ph.D., 1954.

Research and Research Administration Experience:
Actively engaged in research since 1950.
Associate Marine Scientist, Virginia Institute of Marine Science (formerly Virginia Fisheries Laboratory), 1955–59.
Acting Director, Virginia Institute of Marine Science, 1959.
Director, Virginia Institute of Marine Science, 1959–.
Teaching and Academic Administration Experience:
Instructor in Biology, University of Richmond, 1951.
Assistant Professor of Biology and Chemistry, The Citadel, 1954–55.
Associate Professor of Marine Science, Department of Biology, College of William and Mary, 1955–59.
Professor of Marine Science and Head, Department of Marine Science, College of William and Mary, 1959–61.
Dean, School of Marine Science and Professor of Marine Science, College of William and Mary, 1961–.
Chairman, Department of Marine Science and Professor of Marine Science, University of Virginia, 1963–.

PROFESSIONAL SOCIETIES, SERVICE COMMITTEES, AND HONORS

Chairman Pro-Tem—Council of Maritime States, Commonwealth and Territories.
Chairman Pro-Tem—Interagency Coordinating Committee on Water Resources.
Past President and Member—Atlantic Estuarine Research Society.
Chairman—Society for Exploration of the Atlantic Shelf.
Chairman—Atlantic Bight Subcommittee, Atlantic States Marine Fisheries Commission.
Past Chairman and Member—Chesapeake Research Council.
Member Advisory Committee on the Jellyfish Program.
Member—National Sea Grant Colleges Committee.
Member—Biological Committee, Atlantic States Marine Fisheries Commission.
Member—Governor's Inter-Agency Committee on Environmental Health.
Member—Virginia Academy of Science, Committee on Science Education in Virginia.
Member—Virginia Academy of Science, Visiting Scientist Program.
Member—National Technical Advisory Committee on Water Quality Criteria for Federal Water Pollution Control Administration, U.S. Department of Interior.
Member—Commission to Study Seafood Laws of Virginia, 1960–61.
Member—Marine Resources Study Commission, 1966–67.
Member—Statewide Advisory Committee—Water Resources Research Center.
Member—Editorial Committee. Helminthological Society of Washington, D.C.
Member—Biology-Marine Biology Study Committee, William and Mary, 1959–61.
Member—American Institute of Biological Scientists.
Member—Association of Southeastern Biologists.
Member—American Society of Limnology and Oceanography.
Member—American Society of Parasitologists.
Member—American Microscopical Society.
Member—Helminthological Society of Washington, D.C.
Member—National Shellfisheries Association.
Member—Board of Administration, VFL 1959–62 & Secretary, Board of Administration Virginia Institute of Marine Science 1962—Present.
Member—Board of Trustees, Mariners Museum of Newport News, Virginia.
Member and former Director—Gloucester County Chamber of Commerce.
Member—Marine Resources Committee, Virginia Chamber of Commerce.
Member—Board of Directors, York River Yacht Club.
Fellow—American Association for the Advancement of Science.
Member—Beta Beta Beta, Honorary Biological Fraternity.
Member—Sigma Xi.
Member—Board of Trustees, Chesapeake Bay Foundation.
Member—Chesapeake Bay Foundation, Policy and Scientific Review Committee.
Member—Advisory Panel for Sea Grant Projects.
Member—Editorial Review Board, Contributions of Marine Science Institute of the University of Texas.
Member—Chesapeake Bay Task Group of the Committee on Multiple Use of the Coastal Zone of the National Council on Marine Resources and Engineering Development.
Director—Virginia Salt Water Sport Fishing Association.
Member—Board of Directors, Bank of Gloucester.

Designated by Governor Mills E. Godwin, June 27, 1967, as a primary contact in carrying out the comprehensive study of the pollution problems in the Nation's estuaries by the Federal Water Pollution Control Administration, U.S. Department of Interior.

Biolgraphical Listings in American Men of Science, Who's Who in America, Who's Who in the South and Southwest, Who's Who in American Education, Leaders in American Science.

Representative for Virginia, appointed March 8, 1967, by Honorable Mills E. Godwin, Governor of Virginia, on Chesapeake Bay Study in connection with Chesapeake Bay Model.

Representative for Virginia on matters concerning Sea and States and Law of the Sea.

Contributions

Author of 41 Research Publications, Editor of 15 Scientific Translations, author of several statements and letters concerning pending and passed major Oceanography legislation to the Congress of the United States during last 10 years (General Subjects—National Oceanography Program. Fisheries Research, Sea Grant Colleges, Marine Resources).

Military Service

U.S. Army Air Force, T/Sgt. 1943–45; USAAF Enlisted Reserve 1945–48; USAAF Officers Reserve Second Lt. 1948–55.

Hobbies

Sailing, powerboating, painting and photography.

STATEMENT OF WILLIAM J. HARGIS, JR., PH. D., DIRECTOR, VIRGINIA INSTITUTE OF MARINE SCIENCE, REPRESENTING THE COMMONWEALTH OF VIRGINIA; THE VIRGINIA INSTITUTE OF MARINE SCIENCE; THE COUNCIL OF MARTIME STATES, COMMONWEALTHS AND TERRITORIES

Dr. HARGIS. Thank you.

Mr. ROGERS. You may proceed, Dr. Hargis.

Dr. HARGIS. Mr. Chairman and gentlemen of the subcommittee, as the chairman has indicated, I am representing today the Council of Maritime States, Commonwealths and Territories; the Commonwealth of Virginia; and its research agency in the executive branch of the Commonwealth government, the Virginia Institute of Marine Science.

I think it would probably be more orderly if I read directly. However, I would welcome any interjections, comments and questions at any point, Mr. Chairman.

Mr. ROGERS. Very well. You may proceed.

Dr. HARGIS. This committee and the Congress have done much for the marine environment, its resources, the marine resource-based activities of society and for marine science—oceanography—engineering and technology and do not have to be reminded of their importance. These hearings and the various congressional activities preceeding them are ample testimony to this.

Having had the privilege of serving and working with you on oceanographic matters several times in the last 10 years, I am pleased to appear again to comment briefly on some of these topics with emphasis on the developing—now very slowly, unfortunately—national oceanographic program, the COMSER or Stratton report and certain of its recommendations, the marine resources and related items.

I have already named the organizations that I am representing. The Council of Maritime States, Commonwealths, and Territories is

in the early stages of formation. Designed to represent an especially important but, heretofore, largely silent segment of the Nation's total "oceanographic" effort—the official State oceanographic programs, the council is in the process of developing its charter and organization based upon plans made and actions taken at the November 1968 conference—sponsored by the chairman's home State, the State of Florida and Governor Kirk—entitled "The Sea and the States: Mutual Problems and the Solutions."

Later meetings in Oregon—the "Coastal States Conference on a Multiple Use Approach to Ocean Mining Law" called by Governor McCall—and in Washington, D.C.—in association with the National Security Industrial Association—OSTAC annual meeting—have been arenas for further action.

At these meetings the various representatives designed by the Governors' offices have met and discussed this program.

I wish also to make several comments on behalf of the Commonwealth of Virginia and its principal oceanographic research, service and educational agency, the Virginia Institute of Marine Science.

The Executive Committee of the Council of Maritime States, Commonwealths, and Territories met in Washington on April 23 and 24, 1969, and arranged the following statement and authorized me to make it on behalf of the council. The States of Alaska, Florida, Georgia, North Carolina, Virginia, Rhode Island, and Maine were represented. (Representation included four of the seven members of the executive committee.)

Despite the fact that State governments, and this is the statement of the council, have not been well represented in the development of the national oceanographic program thus far, they should be because they are the chief beneficiaries and managers of that most important segment of the oceans, the coastal zone.

Hopefully, the council will help remove this lack. Along with industry, the Federal Government, and the academic community, the States are essential to any truly national oceanographic program.

During and between these meetings, the members of our executive committee have carefully reviewed the reports of the Stratton Commission (COMSER). We have also heard opinions from some of the Commissioners, themselves (Dr. Sullivan in the audience has talked with us), as well as from interested Congressmen, Federal executive agency representatives, and industry.

Regardless of the fate of the specific recommendations of the Commission, this body is convinced that much greater attention must be given to the marine environment and its resources and their problems than they have received thus far.

The future well-being of our country depends, in large measure, on the sea. If accomplishment of this vital objective so requires, we recommend that a coordinating and action organization—called the National Oceanographic and Atmospheric Agency in the COMSER report—be established within the Federal Government for this purpose. It must be given the stature, structure, financial support, and permanence of security to permit effective action.

There is no doubt that this agency must incorporate the functional responsibilities and operating capabilities now scattered widely among several Federal departments, agencies, administrations, and bureaus

as the Commission has concluded. However, at this point, the council is not prepared to specify further either the details of makeup or the operating base or home of this agency.

The council wishes to point out that, despite the frequent usage of and emphasis on the words oceanography or oceanology in the reports of past commissions and committee—NAS–NRC Committee on Oceanography, PSAC, and the National Council on Marine Resources and Engineering Development, for example—and the present COMSER document, the ultimate justification for all this activity is the need that the people of the United States have, and their authorized representatives and institutions, to know more about the marine environment, its resources, and their innate requirements and capabilities, the marine resource-based needs of the United States and its political and legal entities and activities and the problems associated with their use, development, and preservation.

If I can interject here, working for the past 10 years with the General Assembly of the Commonwealth of Virginia and attempting to work with the Congress to persuade both bodies to allow us to invest more funds in research, in advisory services, and in development of management skills, it has become clear to me that while the Congress and while the general assembly are interested in the fact that I, as an oceanographer, am satisfying some curiosity to learn more about the marine environment, in reality, I believe what the Congress wants and the general assembly wants is hard information to help the executive management agencies as well as the legislative bodies to make wise decisions on the marine resources and their uses and their future.

So that I think that I am encouraged by the Commission's emphasis on this aspect, on management, on wise management of the marine resources.

It is on this basis I believe that we ought to attempt to persuade the public to put more funds into oceanography, not because of the innate interest that oceanographers have in oceanography but because of the practical value of the information that we can generate.

The Council of Maritime States, Commonwealths, and Territories is especially encouraged that the Commission emphasized the importance of the coastal zone—the area where sea and land merge and where the greatest direct benefits accrue and damages occur.

We concur with the Commission that greater attention must be given to the tidal rivers, estuaries, bays, and bights of the coastal zone and the adjacent Continental Shelf and slope areas of the high seas.

We must also express agreement with the Commission's insistence that local governments have primary responsibility for management of the affairs and resources of the coastal zone, excluding much of the navigation, commerce, and defense which are recognized to be national in character and, hence, a responsibility shared with or assigned to the Federal Government.

The concepts of coastal zone authorities as centers for coastal zone management and planning activities and coastal zone laboratories as centers for coastal zone research, advisory services, and associated educational activities are interesting and should be encouraged.

In our opinion these are two of the most valuable contributions that the Commission's report has made, that is, in accordance with the

interests of the States. It is especially important, however, that these programs be developed in concert with the maritime States and that they be sufficiently flexible to accommodate justifiable variations.

Various States, various regions will have historical and other bases for making some variations in the arrangements. The Federal Government can function to develop model or prototype organizations, encourage their realization as operating entities with funds and advice and to assist additionally with development of regional projects and programs and financial support of large-scale facilities and programs.

Details must be developed with the States and the States must be encouraged to accept their own financial and operational responsibilities. This is an area which deserves specific attention.

The States need assistance along these lines.

It must be pointed out that these areas and activities are not a vacuum in which nothing exists and no substantial efforts have been made. The Commission did not assume so and neither should we. Most States have or are developing mechanisms for management of marine resources and marine areas. Many support substantial research programs. Several interstate marine resource-management arrangements exist—the Potomac River Fisheries Commission, for example, which is operating in this region of interstate marine resource management very effectively, I think. Nuclei for others are emerging in the mid-Atlantic region.

For example, we hope that within the next several years the States of Maryland and Virginia will be able to make a satisfactory arrangement for a management approach to the Chesapeake Bay. (This last is specifically from Virginia's point of view now, not the Maritime States Council.)

Despite the complexities of the management and research efforts that have been or must yet be developed, which at times confound and confuse us all, it would be a mistake to assume that there are any simple or easy ways of achieving the necessary control over or accommodation to the marine environment and its resources.

We always look at the complexities of a problem and hope that simpler arrangements can be made. In this instance I don't believe that simpler arrangements will help a great deal. I think there is no way that we can significantly simplify the system, that is the marine resource and environmental management systems needs and its problems, except by drastically reducing the numbers of people and diminishing their demands on the seas.

Our problem, as I am sure you all recognize, is that there are more people impinging on the coastal zone and they want more from it and quite often their desires and needs are in conflict and this pressure is increasing and the complexities are increasing. There is no simple way out. We have to work at it but there is no simple way out.

Operations research or systems analysis can help, increased scientific activity will assist, greater engineering and technological capabilities will enhance, and new or revitalized organizations will improve our ability to manage the seas but as long as people and their demands and requirements grow, so also will the problems of the marine resources, the marine environment, and of effecting proper management thereof.

We are going to have to work at it. We are going to have to invest money and time and management skills. In my opinion one of the things that is affecting our marine resources industries, most particularly fisheries, is lack of proper attention to modern management skills.

Every effort should be made, as COMSER has indicated, to keep waste and unnecessary duplication to a minimum and to maximize our collective capabilities but there will be no easy solutions. We must analyze and build, reorganize, restructure and refinance, renovate, and review our scientific and management programs. However, we must avoid the easy option of unnecessary or unjustified replication or of reorganizations and renamings which accomplish little.

It won't do merely to establish a new agency, rename it and not do anything to improve its operations capability.

Turning attention briefly to Virginia you should know that our opinions on the COMSER report and its recommendations are essentially the same as those developed by the executive committee of the Council of Maritime States, Commonwealths, and Territories presented above.

The Commonwealth's direct dependence on the marine environment is clear. Some 30 of about 90 counties within Virginia are in the "Greater Tidewater" or "Maritime Virginia" areas. On or near the coast are her major cities, commerce, industries, tourist activities, and population pressures. I have attached a copy of Marine Resources of Virginia which is somewhat outdated but it indicates that Virginia has been aware for some time of the importance of its Coastal Zone.

(The information follows:)

THE MARINE RESOURCES OF VIRGINIA, THEIR DEVELOPMENT, USE AND PRESERVATION

AN ABSTRACT

Virginia's marine resources encompass all the physical, biological and aesthetic attributes of her 13,000 square miles of marine waters and bottoms and 4,000 statute miles of shorelines, beaches and marshland.

The economy of the Commonwealth is closely related to these valuable resources. Maritime Virginia, that region extending from the Continental Shelf to the fall line of the ocean's tributaries is our most populous, productive and fastest growing area. Sixty percent of all Virginians live in one third of the counties and the population increase has been 98 percent in twenty years. A 37 percent increase is anticipated in the next six (6) years along the James. Seven billions of dollars change hands annually.

The combined forces of population, industrial, recreational and shipping growth along with more military activity are placing greater and greater demands on the marine environment for water, food, recreation, building sites and waste disposal. While these sociological and economic segments enjoy the blessings of Virginia's marine resources, they also degrade them, often in such a way that nature, unaided, cannot compensate.

Destructive degradation must be prevented or minimized. To do this there is need for better planning and management, for better standards. This will involve modern decision-making techniques such as operations research or resource engineering using latest methods for analysis and decision, plus more adequate planning—even zoning, plus more realistic legislative and executive and private regulation of marine resource uses and users.

All these activities require facts, knowledge about the resources, themselves, and the pressures to which they are or will be subjected. This means continuing research on marine resources and continuing evaluation of their usage and condition. Education of and cooperation between science, the public and political persons and groups in an absolute necessity.

PREFACE

THE SEA—boundless source of energy, water, food, joy and wonder; engine of weather; highway for commerce; avenue of attack; bastion of defense; receptable of society's wastes; repository of earth's soil; theater of history; scroll of the ages; cradle of life—It is Important—It Must Be Known. THIS IS THE BUSINESS OF MARINE SCIENCE.

THE PAST

Virginia was colonized via the sea, her early economic, social and political development was near the shores of the sea, her connection with the mother country was through the sea, protection and severance from a wrathful and oppressive government was provided in significant measure by the sea. Virginians have been succored, amused, and terrorized by the sea and her major cities are on tidal tributaries of the sea. Despite this, Virginia's chief attention was directed landward early and this direction persisted for many years—well into the present century. Now attention is finally returning to the marine environment. It is being forced to.

Except for casual mention of marine fishery products, when development, use and conservation of natural resources are considered, soils, forests, mineral resources, and wildlife receive the chief attention, often in that order. Though no one will deny the importance of these terrestrial resources it is necessary and timely that the marine resources receive their portion of our attention. This need is becoming increasingly apparent. Dramatic events of recent years have demonstrated that our tidal waters are not as inexhaustible or indestructible as was once thought.

ECONOMIC ASSETS OF TIDEWATER VIRGINIA

Though aesthetically displeasing to some, it often helps to focus attention on a subject by citing its economic and social impacts. Dollars talk! Forcefully—and sometimes crudely, roughly and thoughtlessly. For a complete breakdown of the economic assets of Maritime Virginia see Appendix I.

Tidewater or Maritime Virginia consists of those counties, cities and towns located at the fall line and eastward to the sea. Included are approximately 33—about a third—of her counties and the largest cities and suburban areas. Almost 60 percent of the people live in Tidewater, where the greatest population and industrial growth in Virginia has occurred. Almost seven billion dollars change hands in Maritime Virginia each year. Much of this commerce is directly related to activities oriented toward marine resources. The capitalized value of marine resources, whether self-renewing or depletable and of marine oriented industrial, residential and commercial activities is great, exceding several hundred billions.

VIRGINIA'S MARINE RESOURCES

What are Virginia's marine resources? What makes Tidewater so important and enables it to make the major contribution to the economic well-being of the entire Commonwealth?

The marine waters

The *marine waters*, themselves, are important. Virginia has responsibility over or ready access to 13,000 square miles of sea water. These waters serve as sea lanes, as highways, to float and facilitate movement of the merchant and naval fleets of the United States and half the countries of the globe. They receive, remove and purify, within limits, the wastes of these fleets. They provide water to cool the power plants and clean and succor the sailors. It is because of the importance of these waters to coastal and international commerce and communications that the major industrial units, the military bases and the major communities of eastern Virginia have arisen. Growing recreational fleets make use of these attributes.

The lovely waters of the Virginian Sea (Captain John Smith's name for the mid-Atlantic between Capes Hatteras and Cod), Chesapeake Bay and the tidal rivers stretching far inland are sources of wonderment and beauty and provide the setting for shorebound beauties or even serve as the main attraction, aesthetic value, of eastern Virginia. People are fascinated, rested and restored or rejuvenated by the ageless, limitless, inconsistent face of the sea. This attribute in itself is of great, though not readily calculable value to society. Despite the

difficulty of directly evaluating the dollar worth of the aesthetic features of the marine resources they do, however, engender vast economic activities and production.

The combination of sea, sand and sun is usually irrestible. Hundreds of thousands of people are attracted temporarily (tourists and vacationists) and permanently to the shorelines of the State, partially because of the water. Williamsburg, Jamestown and the towns, homes and river plantations of the James and other estuaries are made more attractive by the proximity of attractive waters and shorelines. Industrial and military recruiting in the area is made easier by their presence, though this is not an unmixed blessing.

Marine waters with their special properties support profuse and diverse forms of life which in themselves are interesting and useful resources.

The waters of the sea, especially the brackish waters of the estuaries serve as processing and, more generally, cooling waters for industry and shipping. Estuarine and marine waters also receive, to dilute, disperse and transform, it is hoped, the waste materials and waters from the major cities. For example, they are used variously as primary, secondary or tertiary and final sewage treatment plants for Richmond, Petersburg, Hopewell, Newport News, Norfolk, West Point, Fredericksburg and the metropolitan Washington complex, *etc.* and the major industries of the State. Wastes of *all* types including agricultural and radioactive materials reach the estuaries and the sea. This use has saved communities and industries millions of dollars but has often been a wasteful and destructive process. We have not hesitated to put marine waters to this use—we should recognize their service in any accounting of valuable marine resources.

Because they function as an almost universal solvent, the waters of the sea receive, dissolve, hold and sometimes release, most of the important elements and compounds known. Because of this it is a rich natural nutrient for life from the lowest to the highest forms.

In addition, the waters of the sea serve as storehouses of energy, moderators of weather, determiners of climate and as the central reservoir of 90 per cent of the earth's water. The ocean is our ultimate source of water—it is our greatest water reservoir.

Marine waters, especially the less salty estuarine waters, will be increasingly used for drinking, irrigation and process water. To do this, special techniques of capturing less salty surface waters or of desalting the marine or estuarine waters will have to be developed.

Valuable though they are, these waters also are the cause of economic loss and death. Destruction of real property by slow erosion or swift storm damage is not uncommon. Loss of life and property on land and ships and their cargoes at sea are frequent.

Increasing contamination by chemicals, sewage, radioactivity, silt, heat and multiple, sometimes destructive, use of these waters both above and below their fall lines pose serious threats to their cleanliness and utility and undoubtedly affect their habitability by marine organisms of all kinds.

Shorelines, beaches and bottoms

The waters of the Virginian Sea and the estuaries are bounded and contained by shorelines and bottoms which, themselves, play important roles in the ecology of the marine environment and in the economy of the Commonwealth.

There are over 4,000 statute miles of tidal shoreline in Virginia. These vary from salt marshes and muddy flats to sandy ocean and river beaches and high bluffs. Some are stable—some are not.

Shorelines are economically and aesthetically valuable. Almost everyone likes to wander along a sandy strand. This is a peaceful and healing pleasure. Many people wish to build permanent or vacation homes along ocean and bay beaches and water. Residential shoreline is extremely valuable, often costing over $100 a linear foot, unimproved.

Pleasure beaches are particularly valuable not only in cost per linear foot but attractiveness to recreationists with money from elsewhere. So valuable are they that expensive engineering works whose sole function is to protect the beaches and resort properties and costly programs of beach replenishment are justified. To remedy damage caused to Virginia Beach by the "Ash Wednesday (1962) Storm" cost over ten million dollars and a continuous replenishment program is underway. Because of building and replenishment programs like this, submarine sand has become a valuable resource and a search is on for sources of high quality strategically located sand for beach nourishment.

Though, perhaps, not as aesthetically pleasing as sandy shores or high bluffs, tidal marshes are nonetheless extremely valuable. Because of their high plant productivity, they supply a great deal of nutrient material to the main streams as their annual cycles of growth, death and decay continue endlessly. Many tidal flats produce as much converted energy per acre as farm land of highest productivity and they do it without any effort by man. Tidal marshes are important "respiration areas" and play significant roles in the overall circulation and energy balance of our estuaries. Salt marshes now serve as nursery areas for many species of fishes, crabs and other marine animals. In short, salt and estuarine marshes are extremely important to the marine environment and the welfare of marine organisms. Marshes also support shore and wetland birds and mammals. Hunters derive great enjoyment and spend $603,000 each year to hunt in Virginia's tidal lowlands.

Shorelines are being occupied at increasing rate by private property owners, resort owners, communities and industries. The era of untrammeled beaches is rapidly ending. Marshes are being drained and filled at an increasing rate. Virginia *must* be careful that wetland destruction does not destroy the useful and aesthetic attributes of our marine areas. Public beaches must be provided and "virgin" wetlands must be set aside.

Bottoms from the low water line out are obviously as extensive in area as the waters they underlie. Virginia's marine bottoms are valuable, containing many valuable natural attributes and resources. The nearer the surface of the water they lie the more valuable they are, within limits. Natural growth and culture of valuable shellfish, such as oysters, hard clams and soft clams, makes many acres of bottoms extremely valuable. Those not preserved to the public, *i.e.*, outside the Baylor Survey boundaries, are much sought after by private planters as oyster leases from the Commonwealth. Under lease they are nurtured, bartered and passed on as valuable land properties. Indeed, crops produced on these lands by oyster farmers can bring more money per acre than the best farm land. Properly managed, even with information now at hand, those grounds in public care can be just as productive. Perhaps the most productive oyster grounds in the world are those of the lower James estuary which have served as oyster seed beds and original sources of over 75 per cent of all oysters grown in lower Chesapeake Bay for many years.

In addition to serving as beds and sources of shelter, support and nutrients for important marine animals, Virginia's tidal bottoms contain valuable deposits of gravel which have been dredged for use in construction and commerce for sometime. Furthermore, fossil and recent, but overlain, submerged oyster shell reefs have been exploited for years, not only for oyster repletion programs, but also to manufacture lime and chicken feed and for other industrial uses. Use of this non-renewable resource for industrial purposes is rapidly increasing and a sizeable shell-dredging operation has developed in Virginia waters.

Sand has long been used in construction projects. The islands of the new Chesapeake Bay Bridge-Tunnel and much other commercially valuable land has been built of submarine sand.

The bottoms also serve as substrates for many bacteria and animals and plants which may be themselves necessary to the ecological web of these marine environments or may serve as food or attractants to important fishes and crabs.

Indeed, unseen and unappreciated as they usually are, the sandy, muddy, light and dark bottoms of Virginia's estuaries, bays and sea are natural resources of great value to the Commonwealth. There bottoms can become contaminated by silt, chemical and radioactive wastes. Nursery areas and clam, oyster and crab beds can be destroyed completely. Being essentially non-renewable resources, gravel and shell can be depleted. Contamination and destruction must be prevented and over use of shell and gravel resources must not be allowed to occur. These things can be accomplished only if we understand processes and results of contamination and if we know what our usable stocks of resources are. We do not as yet.

Marine organisms

In the past talk of Virginia's marine resources has centered around marine life, more specifically those marine organisms that could be caught, processed and marketed for a profit (see Appendix I.) We have seen above that there are useful marine resources other than the biological; however, because they are living, transient and greatly variable in quantity the fishery resources have received much attention.

Many fishes and several molluses and the blue crab are economically valuable and are now being utilized. Others in each of these general classes of living things to which these animals belong could be utilized were markets developed or new capturing and processing techniques perfected. Still others could be utilized or utilized more efficiently were adequate cultural, aqui- or mariculture, and processing techniques developed.

Many plants and animals, though not directly useful to Virginia, are—nevertheless—necessary to the food chains (the web of life) that supports other valuable fishes and processes. Some marine animals and plants, for example, certain jelly fish, shipworms and grubs, fouling organisms, oyster drills, oyster worms, red-water organisms and parasites, are "natural resources in reverse." They disrupt man's marine-oriented activities and affect his plans and economy. Even they, however, have a place in the natural scheme of things which it may not be wise to unbalance too readily by their mass destruction.

Molluscs—oysters, hard clams, soft clams, surf clams, mussels, scallops, snails, squid

Of all the groups of marine organisms represented in the marine environment the molluscs are the most valuable. The rich, actual or potential, economic fauna includes the Atlantic oyster, hard clam, soft clam, surf clam, sea scallop, mussels, whelks and conchs and other small snails. Though used primarily as bait for sport fishermen, some squid are caught and sold for food. Almost all of these could probably stand heavier exploitation were proper methods used and markets available (see Appendix II).

The molluscs are also most likely prospects for actual farming or mariculture. It is not surprising, therefore, that oysters and hard clams are being crudely farmed and that it is on these species that actual breeding and controlled hatching and rearing work is being done by science and industry. Even under present inadequate culture methods and notwithstanding temporary short- or long-term difficulties resulting from diseases and predators, Virginia's oyster production could be doubled or tripled in a short period of time with very little effort. The technique and scientific know-how are available. Though some of Virginia's problems in not increasing production stem from traditional social practices, some are due to an antiquated and backward outlook by the industry and some are due to poor or inappropriate private and public management practices.

As far as is known all marine animals are sensitive to the wastes of society but because they are largely fixed in position and cannot readily escape, molluscs are especially vulnerable to long-term contamination of their home waters by chemicals, heat or silt. Though small amounts of domestic sewage may be beneficial, which possibility should be considered and utilized where possible, large amounts are detrimental as are almost all industrial and radioactive wastes. Estuarine and coastal waters must remain as pollution-free as possible.

Finfishes

Many species of fishes live in Virginia waters. Many are already exploited and many more could be utilized were markets available or were the need for additional protein really great (see Appendix III). Of those now being used, only four or five are being exploited to or beyond their probable maximum capacity.

Indications are that at present levels of exploitation man's activities have little effect on population levels of most fishes. Natural factors of hydroclimatology are of greater significance. However, long-term changes in water quality or in the nursery and spawning areas may be affecting the finfisheries, especially those whose survival depends upon the availability of special, often restricted, waters and bottoms for parts of their life histories.

Crustacea

Virginia predominates in production of the blue crab. Though the supply fluctuates, it has generally been adequate to meet demands. Delicious crab products are, or should be, well known to everyone. The population might be exploited more heavily. Lobster is also caught and other crustaceans might be used (see Appendix IV). Crustacea are susceptible to overfishing, pollution and destruction of nursery and spawning areas by siltation and engineering changes.

Other organisms

Though not commercially exploited or perhaps even exploitable, many microscopic marine plants and invertebrates are useful as food for higher organisms. In addition, their qualitative and quantitative distribution may serve to indicate

water quality. Quite often governmental and industrial groups interested in maintaining natural waters are not brought into action until some plant or animal has clearly indicated poor conditions, e.g., severe mortalities of fishes and invertebrates, plankton blooms, macroalgae destruction.

Virginia still possesses a wealth of useful marine organisms. From them she derives revenues at landing of about 22 million dollars. About 10,000 people are directly involved. At wholesale and retail the amounts of money and people involved double and triple. Seafoods have long been a part of the Virginia scene, a part worth preserving not only for the delightful variety they provide but because they will be really needed in the future.

An especial value of these resources is the fact that they are largely self-renewing. That is they replenish themselves regularly with very little capital investment from man. Were we to back calculate their capital value to Virginia at 10 percent per annum, it is plain that an investment of $200,000,000 dollars, a too conservative figure, would be required as the capital investment in any manufacturing industry in order to produce such an annual sum. It is in this way that comparisons should be made when plans are being made for industrialization and development of the marine resource systems.

Sport fishing

Marine organisms are more useful and perhaps more heavily exploited for recreational and aesthetic purposes than for commercial reasons. It is impossible to place values on the expectation and thrills of merely seeing animals and plants in the water. Though some are at times nuisances and repulsive, like jelly fish and watermilfoil, it is likely that most of the fascination inherent in estuarine and marine waters would not be there were animals and plants gone. Absent would be the lure of wading along and flushing and observing small fishes and crabs and no delightful treasures would be washed upon the beaches for amateur beachcombers to find and squirrel away. Sport fishermen are rapidly rivaling commercial exploiters as uers and sources of pressure on fishing stocks. Though estimates are available for sport fishing expenditures they tell only part of the story.

Though not strictly aquatic or marine, ducks, shorebirds and certain fur-bearing mammals are regular inhabitants of tidal marshes. Each year 13,000 sportsmen spend over half a million dollars to enjoy these self-renewing resources of Virginia tidal marshes. Thus, not only is marshland valuable and essential as nursery areas for many marine organisms but it is also useful recreationally. Aesthetically, marine marshes are beautiful, wild often lonely places where many wonderful birds and animals can be seen, photographed, hunted and enjoyed. As mentioned above, when marshlands are destroyed not only is estuarine production of other marine animals reduced but these marsh animals and plants, themselves, are gone forever.

It might be mentioned that the ocean of air above us is a valuable natural resource also and that an uncontaminated atmosphere is an important asset to enjoyment of marine resources. Airborne contaminants fall mostly on the sea (the sea occupies most of Earth's surface) but that is a subject as vast as the sea and will be left for some other time and person.

MARINE RESOURCE PROBLEMS

It has been shown that Virginia has a vast treasure trove of aesthetic and economic wealth in her marine waters. Indeed it is certain that a great part of Virginia's actual and potential wealth is marine oriented.

The marine environment is complex. Most of Virginia's marine resources are located within, along or under the major estuaries and the coastal lagoons or the shallow reaches of the Virginian Sea. In contrast to deeper ocean waters, these are areas where the shore and sea meet, where fresh water from upriver and from other surface and subsurface drainage meets and dilutes the salt water from the sea. Here also the shallow bottoms have their greatest effect on the currents and on the contents, chemistry and biology of the brackish and salt waters above them. These coastal waters receive soil eroded from the land with its minerals and, as a consequence, are usually richer than those of the deep oceans. Estuarine and coastal seas also receive the suspended or dissolved wastes from all cities, towns, homes and industries along all coastal rivers.

With the close and immediate interactions taking place between the land, the sea, the atmosphere, fresh and salt water and society, coastal waters are ex-

tremely complex in nature. Many factors interact to give them their natural characteristics. Because of this inherent complexity, they are difficult to understand and manipulate intelligently.

Complex user requirements

Because of their proximity and accessibility, the coastal waters are the most used and exploitable of all the waters of the world ocean. Many users wish to take their "cuts." Sometimes these uses are in real or apparent conflict with each other and some uses are temporarily or permanently damaging to the resources. The James and Rappahannock rivers are excellent illustrations of the innate complexities of our coastal waters. In their downriver, tidal reaches, both are stratified systems with heavier salt water from the Bay on the bottom and lighter fresh water from the upriver and shoreline drainage areas in the upper layer. The salty bottom water flow upstream even though the fresh flow is downstream. This creates problems as in the case of the lower James where it is certain that a change in the depth of the river bottom will alter the velocity of the upstream flow, change the depth of the lower layer and allow waters of greater salinity to intrude further upriver than before. Though these changes *are* certain the extent is uncertain. Also unknown are the possible repercussions these physical changes, certain to occur, will have on the oyster fishery. It is know that successful larval survival and spat setting and survival depend upon the upstream current and the upstream limits of salinity. This has been the chief natural resource problem in the James River development program up until now.

Changes in the volume rate of flow in the upper, fresher layer are also important in determining success of marine organisms. As a consequence, dams which may be operated in such a way as to change the flow may change the salinity regime and affect survival of oysters, clams and other useful invertebrates by allowing salinity-dependent predators and survivors onto productive bottoms. This prospect is being considered in the plans of the Salem Church Dam on the Rappahannock River.

Engineering projects

Engineering projects such as channel enlargement and realignment and dam construction on our estuaries are numerous and increasing. Each year sees dozens of small and large channel projects: Over 400 small and large dams are proposed for the Potomac system alone for the next several years.

Reservoir construction and operation are not the only engineering difficulties that marine resources must face. Also involved are fill and drainage of salt marshes, filling and erosion of sorelines and waterways, bridge and island construction and siltation resulting from engineering projects. Engineering activities may pose severe threats to marine resources. Conversely, they may also be planned and operated so as to enhance those resources, e.g., reservoir operation to reduce pollution and improve water quality or actually enhance oyster and clam survival and growth, as the Institute and the Corps are attempting to do with the Salem Church project. It is possible, by proper planning to minimize adverse effects.

Contamination

Increasing populations and industrialization along our tidal rivers will be *inevitably* accompanied by increasing contamination—this cannot be escaped at this time. The James and Rappahannock are, even now, being polluted (more than necessary). The problem is one of degree. Pollution can and must be controlled and minimized. Difficulties in setting allowable tolerances for marine water quality are encountered because we lack the detailed information concerning the physiological responses of the organisms necessary to set such limits.

Shoreline Use

Virginia's shorelines are rapidly being occupied. Potential shoreline for industrial, residential and recreational use are diminishing. In many areas the most valuable shores are already gone. It is important that those remaining be husbanded wisely. We must be esepcially careful that the urge to grow and industrialize does not eliminate natural areas important to the ecology of the estuaries, the survival of important organisms, the recreational activities of man and aesthetic uses. Only the bare minimum of degradation must be allowed. For this reason plans for the use of this land should and must be developed well ahead of pressures.

It is a happy characteristic of our system that enterprise is encouraged and that individuals, communities and industries and even states promote their own interests, growth and development. Unfortunately, quite often these promotions create unforeseen pressures on the natural environment. Often they create pressures that are contrary to, or augmented by, the desires of existing users. As an example, a manufacturing industry may wish to use estuarine waters to cool or in processing and to receive its wastes. These desires even within a single economic unit may conflict. The employees of that plant and the community in which it is located may use the water to swim and fish and for the disposal of wastes and the shorelines as homesites. These may also conflict with each other and the industry that they serve.

Exploitation of Marine Organisms

Destruction or degradation of the marine habitats by poorly conceived and operated engineering projects, by contaminants and siltation serve to eliminate or reduce marine organisms. Also, important are the harvesting activities of man.

As has been mentioned above (see also Appendices II, III, and IV) most commercial or sport species of finfish and molluscs in Virginia waters are not being exploited to their fullest. However, a few are and great care must be taken not to eliminate these much used forms. Furthermore, we must always be careful not to exceed that fine point beyond which rational exploitation becomes too heavy and destructive. All too often we cannot even recognize this point. Because survival and success of marine animals and plants depends upon so many factors including not only those actually or potentially destructive activities of man mentioned above but also natural catastrophes or changes, complete understanding of these factors is necessary and continuous surveillance obligatory.

In the past, heavy dependence has been placed upon regulation of fishing pressures by law. With more adequate knowledge this approach has been shown to be fruitful in only a few cases. Often the restrictions have served no useful purpose. It is especially important that laws and regulations and other management decisions and devices be based upon the resources themselves and not upon uninformed whim, opinion or pressure. To have it otherwise accomplishes nothing but wasteful restriction.

In order to successfully make use of and conserve the living marine resources, it will be necessary to learn more about their ecological requirements and their physiological responses. In addition, a continuous and careful monitoring of the stocks of all major species is needed.

For many species, it seems unlikely that we can really do much to increase their numbers. They must, of course, be protected from over-utilization and from the problems of environmental destruction. Some species can be increased by special practices such as utilizing productivity generated by human wastes or by other environmental improvements. Especially susceptible to purposeful culture are the molluscs which probably will be hatched, reared and grown under controlled conditions to get as far away from the vagaries of nature as possible. A substantial start has been made on this. In the meantime, we can, if we will, double production now merely by revising archaic practices and following more modern procedures.

THE FUTURE

We have seen that the Commonwealth's marine resources are very valuable and much more important to her economy than most acknowledge or even suspect. Virginia is truly a maritime state. Because of their complexity and the multiple, often conflicting demands of their users, wise use and development of these resources will require careful planning and management. Rapidly increasing population levels in the maritime counties and burgeoning industrialization increases the necessity for prompt action.

The marine resources now suffer from poor management practices and as pressure grows their degradation becomes more intense.

Two deficiencies are especially notable. One is antiquated or inadequate decision-making processes which operate inefficiently and in provincial or partisan manner and often not in keeping with the facts concerning the natural resources themselves. The other is the prevailing lack of adequate information on which to base wise decisions. (Obviously, the former depends upon the latter.)

In order to improve Virginia's chances of making optimal use of her natural resources new decision-making systems are needed. Also necessary is a more careful evaluation of goals in resource use.

We must recognize that increasing populations and industrialization entail costs—costs in environmental degradation which must be recognized and minimized, if possible. Some destruction cannot be prevented. Progress, growth and industrialization cannot be halted but they must be controlled. It is wise and businesslike to do so. The cost of failure is aesthetic and economic loss.

In planning local or statewide promotional and developmental activities, careful attention should be given to all the ramifications of any course of action. It has been shown many times that new uses of or additional pressures on the marine resources degrade those resources and are detrimental to their desirable attributes and contrary to the interests of previous users. We must be sure, for example, that increasing industrialization on an estuary will not destroy an important fishery resource or interfere with an established and important tourist or recreational industry, unless we *wish* to sacrifice those activities. Some uses *are* mutually exclusive no matter how they are planned and carried out. Others can be made compatible with careful planning. Still others are compatible from the outset. Though we may be satisfied to allow one established economic use to disappear in favor of another, we must know what we are about.

One thing is certain, progress and virgin, pristine conditions *are* incompatible. If Virginia has any areas which should be preserved in this condition, they must be set aside at once.

One of the keys to better planning is an efficient, effective evaluation system. At present, we employ numerous agencies, regular (VALC) and special appointive commissions or boards, and various executive and legislative groups to evaluate natural resource problems. In general, these have been somewhat effective but in really complex problems they often bog down in spiralling rounds of ineffectual investigation and reporting. They must be assisted. One ready way is for these bodies to make more use of the scientific or technical agencies or bodies and advice now available to them. Not infrequently, plans and management decisions are made and laws and regulations framed and even passed that have no real bearing on improvement of the resource other than intent. Quite often special study groups are established by legislative resolution to answer resource questions that one or more state agencies are actively at work on and can already answer.

Resource engineering

Because of the increasing complexity, urgency and magnitude of these resource management problems, it would be wise to bring such techniques as Operations Research, using high speed digital and analogue computers to consider the variables and evaluate the possibilities and present a rated list of most likely decisions for further consideration by human decision groups.

Through the use of all adequate modern techniques, it should be possible to improve the results of and shorten the time for decision making. This might be called Resource Engineering.

Resource planning and zoning

In these times when a project to benefit one area along a tributary might adversely affect other economic interests, often some distance away, it is important that official bodies and plans concerned with evaluation of an entire river system be developed. One technique is establishment of effective and responsible regional authorities with legal authority to, and responsibility for, zoning along an entire system. Such a group should determine well in advance what marshlands can be sacrificed, what amounts and types of wastes can be tolerated, which areas are to be preserved inviolate for historical or aesthetic reasons, where residential areas can be located, where industrial development can be encouraged and other such matters. The most critical areas for this type of activity are the James River system—and the Potomac River system estuaries in Virginia under greatest pressure.

Knowledge

To solve present and future problems, maintain and improve the marine resources, permit better planning for development and use—no matter what the mechanism for decision making—it will be necessary to have accurate and complete information about the resources. While Virginia's scientists and others have made a good start on acquiring this information and we know much more than when effective work was begun less than twenty years ago, it is apparent that we must learn more. Present knowledge is inadequate because the phenomena

under study were vast and complex to begin with, as mentioned above, and because our efforts at research have been limited in scope. Furthermore, the frame of reference for our studies and decisions have changed drastically in the last twenty years and new variables are being constantly introduced by man himself. Because of these things and the urgent need to prevent irreparable damage it is essential that information be developed at a much more effective rate than that of the present. This will require an enlarged, improved and continued research effort. It must be realized that just as society changes nature itself is not static. Increasing interaction between the two constantly causes changes in the systems science must study.

Continuing research, improved decision making and planning, in that order, are necessary to the wise use of Virginia's marine resources. Also important will be continuous efforts toward improvement in the regulations and enforcement operations of the various state management agencies involved and toward system zoning.

Education of the citizenry and public officials and development of replacement scientists and new techniques are vital.

Appendix I

Outline of statistics on the marine resources of Virginia and associated economic activities

(These data from the 1962 publication entitled "Maritime Virginia" issued by the Virginia Institute of Marine Science, formerly the Virginia Fisheries Laboratory, have been revised where necessary and possible by information from a similar study now underway. Though precise figures are often difficult to obtain, this information can be considered as reasonably accurate.)

I. POPULATION OF MARITIME VIRGINIA, 1960:

Total population of Virginia (Now over 4,000,000 as indicated by 1963 statistics of the U.S. Census Bureau)	3,966,949
Population of Maritime Virginia	2,282,191
Percentage of total in maritime Virginia	57.53
Percentage of 20-year increase for Virginia	48.1
Percentage of 20-year increase for maritime Virginia	97.8
Percentage of 20-year increase for rest of Virginia	11.1
Land area in maritime Virginia	11,559
Percentage State's land area in maritime area	29.0
Number of towns and cities on shoreline	109
Total shoreline communities' populations	1,562,898

Over *57%* of all Virginians live in the *Maritime Area*!
More than 39% of all Virginians live in *Waterfront Communities*!

According to predictions from reliable sources the tidal James River will experience a 37% growth in population by 1970 (500,000 people).

II. SEAFOOD INDUSTRY:

Number of employees in 1960	9,599
Estimated value of capital equipment	$200,000,000
1962 poundage caught	453,900,000
Value of 1962 catch	$21,300,000
30-year average annual catch in pounds	293,602,000
30-year average annual value of catch	$12,888,000

Commercial Fishing in 1960 was 24.9% greater than the past 30-year average, and *62.4% more valuable*!

III. VALUE OF SALT-WATER SPORT FISHING:

1960 estimated value	$31,500,000
1955 estimated value	$24,601,500
5-year increase (28 percent)	6,898,500

Virginia is famous for its salt-water sport fishing, a form of recreation that has increased by an estimated 28% in the past 5 years.

IV. SHIPPING IN VIRGINIA, 1962:

Total tons shipped (short tons, 2000 pounds)	65,569,255
Total foreign shipments (tons)	34,016,596
Value of foreign cargoes	$1,099,066,514
Percentage of Nation's total foreign shipping by Virginia in 1962	9.88
Total domestic shipping	31,552,659
Percentage increase all shipping, 1953–1962	60.4
Percentage increase foreign shipping, 1953–1962	107.1

Rank among east coast (U.S.A.) ports, second.

Virginia Ports out rank *all other major ports* of the United States in *current growth.*

V. VALUE OF SHORE-BASED INDUSTRIES:

Number of shore-based industries, 1960	931
Number of maritime Virginia industrial employees	128,463
Increase in shore-based industries; 1950–1960 (percent)	33.6
Increase in industrial employees; 1950–1960 (percent)	25.9
Estimated gross product value of maritime Virginia manufacturing, 1960	$4,072,255,000

Maritime Virginia, with *931 industries* employing *128,463 employees,* has, in the past ten years, realized a *33.6% growth in number of industries,* and *25.9% in industrial employment.*

VI. ESTIMATED VALUE OF MARITIME VIRGINIA REAL ESTATE, 1960

Value of privately owned land and buildings in maritime Virginia	$10,045,000,000
Number of building permits	40,000
Value of new construction	$380,000,000

Privately-Owned property in Maritime Virginia is worth over *$10-billion,* not including government-owned properties, and construction in 1960 was valued at *$380-million.*

VII. VALUE OF THE MILITARY TO MARITIME VIRGINIA:

Number of installations	11
Employees, military and civilian	127,900
Fleet-based Navy personnel	65,000
Annual spending by naval installations for payroll, goods and services in the maritime area	$1,500,000,000
Estimated annual spending by military for payroll, goods and services in the maritime area	$2,300,000,000

Maritime Virginia harbors one of the greatest concentrations of military power in the world, and the military is important to that economy of Virginia, bringing over $2.3 million annually into this area.

VIII. ESTIMATED VALUE OF TOURIST TRADE TO MARITIME VIRGINIA, 1960:

Number of out-of-State tourists to maritime Virginia	20,000,000
Tourist spending in maritime Virginia	$400,000,000
Number of businesses in maritime area partially or wholly dependent upon tourist trade	16,000

Maritime Virginia is one of the most visited sections of our nation. Approximately *20,000,000 out-of-state tourists* annually spend about $400,000,000, supporting an estimated 16,000 businesses here.

IX. VALUE OF WETLAND HUNTING IN MARITIME VIRGINIA, 1960:

Waterfowl hunters	13,180
1960 values	$602,853
Average annual hunter expenditure (per person)	$45.74

Waterfowl hunting is a popular recreation in Maritime Virginia, with *13,180* participants spending approximately *$602,853* in the bay area in 1960.

X. VALUE OF BOATING IN MARITIME VIRGINIA, 1960:

Estimated number of boats in maritime area	37,205

Approximately 37,205 boat owners in Maritime Virginia partake in the number one outdoor family sport of boating, whether pleasure-riding, water skiing, sailing or fishing.

Appendix II.—*Useful and Potentially Useful Marine Molluscs*

Species	Actually used: Overused	Actually used: Underused	Potentially useful
C. virginica	X		
V. mercenaria (hard clam)	X	X	
Mya arenaria (soft clam)		X	
Mytilus edulis (blue mussel)			X
Modilus demissus (ribbed mussel)			X
Spisula solidissima (surf clam)		X	
Rangia cuneata (marsh clam)			X
Placopecten magollaritus (sea scallop)		X	
Aequipecten irradians (bay scallop)			X
Busycon canaliculatum		X	
Busycon carica (knobbed)		X	
Squid			X

NOTES

Sea scallops—limited numbers off coast, some have been landed at Hampton.
Busycon—shipped cooked to New York City by some dealers.
Bay scallop—might be reintroduced.
Rangia—thousands of bushels now around Jamestown.
M. demissus—animal food.
Prepared by Dexter S. Haven, head, Department of Applied Science.

Appendix III.—*Marine and Estuarine Fishes of Commercial or Sport Importance*

Scientific name (species)	Common name	Commercial importance	Sport importance	Level of exploitation
Carcharhinus milberti	Sand bar shark	Minor	None	Probably underexploited.
Megalops atlantica	Tarpon	None	Minor	Stocks unknown.
Alosa aestivalis	Blueback or glut herring	Major	None	Underexploited.
Alosa mediocris	Hickory shad	Minor	Minor	Do.
Alosa pseudoharengus	Alewife	Major	None	Do.
Alosa sapidissima	American shad	do	Moderate	Adequate, perhaps near maximum.
Brevoortia tyrannus	Menhaden	do	None	Near maximum level.
Gadus morhua	Cod	Minor	Minor	Virginia stocks perhaps temporarily.
Urophycis regius	Spotted hake	do	None	Underexploited.
Urophycis chuss	Squirrel hake	do	do	Stock not known.
Merluccius bilinearis	Silver hake	do	do	Probably underexploited.
Anguilla rostrata	American eel	do	do	Underexploited.
Mugil cephalus	Mullet	do	do	Stock minor in area.
Centropristes striatus	Black sea bass	Major	Moderate	Exploitation moderate, not maximum.
Roccus americanus	White perch	Minor	do	Underexploited.
Roccus saxatilis	Striped bass	Major	Major	Exploitation adequate, near maximum.
Pomatomus saltatrix	Bluefish	Moderate	do	Moderate, not overexploited.
Rachycentron canadum	Cobia	Minor	do	Exploitation adequate.
Seriola spp	Amberjacks	None	Minor	Underexploited.
Coryphaena hippurus	Dolphin	do	Moderate	Do.
Orthopristis chrysopterus	Pigfish	Minor	Minor	Probably underexploited.
Bairdiella chrysura	Silver perch	None	do	Underexploited.
Cynoscion nebulosus	Spotted weakfish	Minor	Moderate	Stocks minor.
Cynoscion regalis	Gray weakfish	Major	Major	Exploitation adequate.
Leiostomus xanthurus	Spot	do	do	Exploitation moderate, not maximum.
Menticirrhus saxatilis	Northern whiting	Moderate	Moderate	Probably underexploited.
Pogonias cromis	Black drum	do	Major	Exploitation adequate.
Sciaenops ocellata	Red drum	Minor	do	Do.
Micropogon undulatus	Atlantic croaker	Major	do	Stock temporarily lost.
Stenotomus chrysops	Scup	do	Minor	Exploitation moderate, not necessarily maximum.
Chaetodipterus faber	Atlantic spadefish	Minor	do	Stock rather limited.
Tautoga onitis	Tautog	do	do	Probably underexploited.
Euthynnus alletteratus	Little tuna	None	Moderate	Underexploited.
Sarda sarda	Atlantic bonita	do	Minor	Do.
Euthynnus pelamis	Oceanic bonita	do	do	Do.
Scomberomorus cavalla	King mackerel	Minor	do	Stock rather limited.
Scomberomorus maculatus	Spanish mackerel	Moderate	do	Stock probably underexploited.

APPENDIX III.—*Marine and Estuarine Fishes of Commercial or Sport Importance*—Continued

Scientific name (species)	Common name	Commercial importance	Sport importance	Level of exploitation
Scomber scombrus	Atlantic mackerel	Moderate	Minor	Exploitation adequate at present stock level.
Thunnus thynnus	Bluefin tuna	Minor	do	Stocksize unknown in local waters.
Xiphias gladius	Swordfish	Major	None	Stocks probably underexploited.
Makaira albida	White marlin	None	Major	Stock probably underfished.
Peprilus alepidotus	Harvestfish	Moderate	None	Probably underexploited.
Poronotus triacanthus	Butterfish	Major	do	Exploitation adequate.
Paralichthys dentatus	Summer flounder	do	Major	Exploitation moderate, but not maximum.
Pseudopleuronectes americanus.	Winter flounder	Minor	Minor	Local stock small but expanding.
Sphaeroides maculatus	Northern puffer	do	Moderate	Stock underexploited.

APPENDIX IV

CRUSTACEANS OF ECONOMIC VALUE IN THE CHESAPEAKE BAY AND THE ADJACENT CONTINENTAL SHELF WATERS

I. Species actively exploited

1. Blue crab, *Callinectes sapidus.* In all saline and brackish waters of Maryland, Virginia, and in inshore waters of the shelf; exploited as hard crabs, soft crabs and peelers (for bait), and crab meal from the picking residues.

II. Species giving substantial financial return, but fishing is incidental to other fishing operations.

1. Northern lobster, *Homarus americanus.* On the continental shelf.

III. Species which do not contribute significantly to the economy, because catch is small, local and seasonal. These species are economically valuable in other areas of the U.S.

1. Edible shrimp (3 species), *Penaeus setiferus, P. duorarum, P. aztecus.* Caught in fish pound nets, by hand dipnet, and small seine, at mouths of Virginia rivers.

2. Rock crab, *Cancer irroratus.* Caught incidentally in deep waters of the Bay and on the continental shelf. Cooked for crab meat extraction.

IV. Species which are abundant and are exploited, but do not contribute significantly to the economy here or elsewhere.

1. Grass (glass) shrimp, *Palaemonetes sp* (3 species). Found in the Chesapeake area; used as chum (bait) in fishing.

V. Species which are relatively abundant, and not presently exploited in the Bay area. Other, similar species are exploited in other areas of the U.S.

1. Sand shrimp (*Crangon septemspinosa.* Small-sized shrimp, 1–2 inches, most numerous near mouths of Virginia rivers, in fall, winter and spring.

Used in other areas of U.S. as bait and for shrimp meal (seasoning).

2. Fiddler crabs, *Uca sp.* There are three species abundant in marshes throughout the Bay area. Used in other areas as bait for tautog.

Prepared by: W. A. Van Engel, Head, Department of Crustaceology.

[From the Virginia Forward]

OCEANOGRAPHY IN VIRGINIA

(Dr. William J. Hargis Jr.)

Dr. William J. Hargis, Jr., who authored this article, is one of the nation's outstanding figures in the burgeoning field of oceanography. He is Director for the Virginia Institute of Marine Science at Gloucester Point, Virginia; Dean, School of Marine Science, The College of William and Mary; Chairman, Department of Marine Science, The University of Virginia.

No ivy-towered dweller, Dr. Hargis is easily conversant in his complicated field and his enthusiasm for a Science, which means increasingly more to all of us, is highly contagious. He's a native of Russell County, Virginia, earned his A. B. and M. A. at the University of Richmond, went on to Florida State University to get his Ph.D. He has been actively engaged in research since 1950. He has been an educator in Biology, Chemistry and Marine Science since 1951.

His list of memberships in professional societies, service committees—and his honors—fill almost a page. He is, for example, past president of the Atlantic Estuarine Research Society, Chairman of the Exploration of the Atlantic Shelf, a member of the Board of Trustees, Mariners Museum of Newport News, Va., and a fellow of the American Association for the Advancement of Science. He has been named by Governor Godwin as a representative for Virginia to important study groups related to pollution problems in the nation's estuaries and to a Chesapeake Bay Study in connection with Cheaspeake Bay Model. Author of 41 research publications and editor of 15 scientific translations, Dr. Hargis names sailing, powerboating, painting and photography as his principal hobbies.

INTRODUCTION

Twice daily the ocean tide rises and falls in the 13 thousand square miles of the Virginia Sea and Chesapeake Bay. Along the 4,000 miles of shoreline, salt and fresh waters of Tidewater alternately cover and uncover rich shallows and marshlands—mixing fertility of soil and sea. Wildfowl, marsh animals, fish and shellfish are spawned in, sheltered or nourished by the enriched broth of the sea. Mineral deposits, fashioned by the ages, are hidden by the inconstant face of the ocean. By surf, beaches are built; under its turbulent roar, coasts are destroyed and highlands fall. Into the waters of the sea, wash the soil of misused land and others of the thousand wastes of man.

Houses, cities and factories rise along the shore. A newly christened ship slides silently down the ways. Upon the ocean a ship moves majestically, commerce or pleasure bent. Silent submarines angle slowly to stations below the sea's blue deck. Fishermen bring from the shallows of the Bay an abundant but varying harvest of crabs, clams, oysters and fish. From deeper shelf waters of the Virginia Sea, draggers scoop fish and scallops and other creatures. A sail shimmers over blue-green waters, while on shore recreationists and householders are refreshed or solaced by the sea.

Beaches and marsh, highlands and deeps, bottoms and shallows, fish and fowl, sea and sky all are of great aesthetic and economic value to the Commonwealth. Each year over 7 billions of dollars change hands in Maritime Virginia, much of it due directly to the marine environment, its resources and attractions.

The early ocean explorer, Captain John Smith—who called that vast shallow area of ocean lying between Capes Cod and Hatteras the Virginian Sea, was among the first Europeans who recognized and publicized the New World's marine resources. By his voyages, observations and writings, he urged their use. Later Virginians and Virginia-based explorers extended man's knowledge of and dominion over the seas markedly. Among those who contributed notably are: Lt. John Mercer Brooke, Virginian and early geological oceanographer, and Admiral Richard E. Byrd, scientists and polar explorer. The worldwide scientific expedition led by Lt. Charles Wilkes, which preceded the renowned voyage of *HMS Challenger*, fitted out and sailed from Hampton Roads in 1838.

Among the earliest proponents of marine research was Virginia's Matthew Fontaine Maury. Maury, a primary founder of modern physical oceanography, recognized the potential importance of marine science or oceanography to man. Along with many other useful projects, he espoused the utility of properly oriented and conducted marine research. As often happens, the prophecy of Maury was far in advance of its realization. Oceanography in the United States languished from his day (the mid-1800's) until very recent times. It is only since 1940 that its military importance has been strongly realized. Civilian oceanography did not develop markedly until 1950. It may be safely estimated that 90 percent of all the activity in marine science has taken place since World War II

WHAT IS OCEANOGRAPHY?

At this point it is well to consider what oceanography is. What is there about oceanography that makes it so important to man?

Oceanography or marine science or oceanology (for they are synonymous as used here) is the study of the oceans and their tributaries and their processes. It is not a basic discipline like physics, biology or chemistry but an interdisciplinary science like geology or meteorology—a science of a large natural system, the oceans.

Scientists interested in phenomena of the marine environment, in the oceans, their shallow seas and tributaries are called oceanographers. Because of the interdisciplinary nature of this field, oceanographers must be able to work in several areas or with specialists from other areas of science. Those interested in biological processes in the sea, or the interrelations between environment and marine life are called biological oceanographers. Marine fishery scientists are specialized biological oceanographers. Chemical oceanographers study the chemicals and the chemical processes in sea water. Geological oceanographers examine the interrelations between sea and sediments and sea and the shores and bottoms. Meterological oceanographers study interactions between atmosphere and oceans, e.g., the relationships between wind and water. Physical oceanographers study the nature and movements of water masses, tides, currents and waves from the viewpoint of the water, itself. Together, all strive to understand and build a picture of that great mass of salt water that covers 71 per cent of our space ship—Earth. Thus, oceanography is a unified science—unified not because it is a basic discipline but because the sea, itself, is a single huge system of water, bottom, shore, air and marine life which must be considered as a whole.

Oceanographers are assisted and accompanied in their studies and subsequent practical activities by marine or ocean technologists of many types. Many kinds of applied scientists and engineers are involved in marrying scientific facts from oceanographic research with engineering principles to produce techniques to help society live with, use and preserve the resources of the sea.

Man has used the sea. As population and industry grow, distances shrink and communications increase, this dependence will increase. Because of the close relationship between the oceans and man because of the utility of the bottoms, waters, shores, life and chemicals of the sea, oceanography clearly is closely coupled with society. Hence, basic research and applied research on the phenomena of the oceans will usually be put to use, quickly.

As predicted by Maury and others, the science of oceanography has proven of great use to the country in its development. It will be even more useful in the future. The great growth of activity in the field since World War II has been prompted by belated realization of this fact.

VIRGINIA'S OCEANOGRAPHIC PROGRAM

In the wake of interest produced by the National Academy of Science-National Research Council Report (by its Committee on Oceanography) entitled, "Oceanography 1960–1970", increasing activity has occurred in all areas of marine science. Many private and public institutions have established new programs or enlarged existing activities in the field. Of late, added stress has been placed on the more applied or practical aspects of marine science and to the need for coordinated efforts in the field.

In this scientific movement toward the sea, Virginia has been a leader. The historical, economic, social and political importance of Maritime Virginia (the 33 tidewater counties which contain 60 percent of the people, three of the largest urban complexes and much of the commerce and industry of the state) has prompted the General Assembly and executive officers of the Commonwealth to establish a major, state-supported coordinated program of research, service and education in marine science and engineering—the Virginia Institute of Marine Science. Under provisions of Chapter 9, Title 28 of the Code, sometimes called the "Oceanographic Law of Virginia," the duties and responsibilities of the program are as follows:

"(a) To conduct studies and investigations of all phases of the seafood and commercial fishing and sport fishing industries;

"(b) To consider means by which fisheries resources may be conserved, developed and replenished and to advise the Commission of Fisheries and other agencies and private groups on these matters;

"(c) To conduct studies and investigations of problems pertaining to the other segments of the maritime economy;

"(d) To conduct studies and investigations of marine pollution in cooperation with the State Water Control Board and the Department of Health and make the resulting data and possible corrective recommendations available to the appropriate agencies.

"(e) To conduct hydrographic and biological studies of the Chesapeake Bay and the tributaries thereof and all the tidal waters of the Commonwealth and the contiguous waters of the Atlantic Ocean;

"(f) To engage in research in the marine sciences and, with proper affiliation with one or more accredited institutions of higher learning, provide education therein;

"(g) To make such special studies and investigations concerning the foregoing as it may be requested to do by the Governor.

"The above studies shall include consideration of the seafood and other marine resources including the waters, bottoms, shorelines, tidal wetlands, beaches and all phenomena and problems related to marine waters and the means by which these marine resources might be conserved, developed and replenished."

Dating to 1940, this charter wisely provides for basic and applied research, technological and engineering developments and for service to the principal users, managers and developers of the state's vast marine resources. It also provides for education in all relevant fields of oceanography and technology. In recent years, a mechanism has been developed to make the laboratories, equipment, ships and other resources of the Institute available to interested scientists and students in other institutions. Conversely, this arrangement provides a mechanism for encouraging others to work on the marine environment and problems of the Commonwealth.

Through VIMS, the General Assembly of Virginia has devoted fairly large amounts of money to oceanography. At this point, the Institute stands among the top ten of all marine institutions (and there are nearly a hundred in the nation) in total size, and among the first three or four in terms of total state-support. It is the largest in percentage of local support. Indications are that among state-supported oceanographic programs, Virginia has the largest on the East Coast (1967 Oceanology Yearbook).

Enlightened and controlled investment in marine science by the Commonwealth has resulted in increasing use of information about the marine environment and its resources in the public and private economic affairs of the Commonwealth. Health, welfare and aesthetics are also being served more actively. Marine scientists and engineers are regularly available for advice and consultation to local and state public management planning and development groups such as the Virginia Division of Industrial Development, the Division of Planning, the Department of Conservation and Economic Development, the Commission of Fisheries, the Water Control Board, the Department of Health, and other executive and legislative bodies. Service to industries of all types, especially to shipping, sport and commercial fishing interests, big water users, and waterfront developers has grown. Virginia's oceanographers also serve as advisors to state and interstate river basin development groups and fishery commissions.

EDUCATION IN OCEANOGRAPHY

Within Virginia, training and educational opportunities in marine science are provided to advanced high school students, high school and college teachers and advanced undergraduates. Graduate courses leading to masters and doctors degrees in Biological Oceanography, General Oceanography and Marine Fisheries Biology are offered by the University of Virginia and the College of William and Mary in conjunction with the Virginia Institute of Marine Science. A minor in Ocean Engineering is available through the former. Electives and research courses in marine science or related fields also are offered at Virginia Polytechnic Institute and Old Dominion College in Norfolk. The latter anticipates development of oceanography graduate programs later. Several other institutions such as Hampton Institute and University of Richmond also have employed marine scientists to teach.

At this writing, the only oceanography courses leading to graduate degrees are those offered at VIMS through the University of Virginia and the College of William and Mary. Enrollment in these has grown markedly from about 6 in 1957 to 55 in 1967. Recently, many qualified applicants have been rejected due to lack of facilities.

Unfortunately, few Virginians have shown interest in the two educational programs. Of 150 applying in 1967, 18 were Virginians—11 of whom were ineligible. Hence, most of the applicants and successful enrollees to these programs are from elsewhere. This trend should and can be reversed by more emphasis on marine sciences at the pre-college and undergraduate levels. Adult education can focus additional attention on this field.

Activities to this end have been undertaken by VIMS; others should follow suit. Each year sees an increasing interest in marine science in Virginia and it is hoped that state and local public school systems and the community college programs will incorporate oceanography in the appropriate places in their curricula. All pre-college students and undergraduates should be exposed to more oceanographic facts in earth science and biology courses, while in some schools oceanography should be offered as electives. More students should be encouraged to take courses at, or seek experience at, seaside laboratories. Certain of the proposed technical and community colleges should provide programs to train field and laboratory marine technicians and fishery technicians.

It is certain that trained oceanographers, marine technicians and engineers resulting from these efforts will have no trouble being employed. Many opportunities are open to trained people at all levels. The pre-college and undergraduate programs outlined above will marketedly increase interest in oceanography and provide a corps on which to build future expansion of research, engineering and industrial development in marine science. And Virginians will be better prepared for education in the academic and research aspects of professional, post-graduate oceanography and engineering.

OCEANOGRAPHIC RESEARCH FACILITIES AND PROGRAMS IN VIRGINIA

VIMS operates laboratories in two locations, the main one at Gloucester Point on the York and the Eastern Shore unit at Wachapreague. In addition, Virginia has built an hydraulic scale model of the tidal James in cooperation with the Norfolk District Engineer's Office and the Waterways Experiment Station of the U.S. Army Corps of Engineers. This excellent estuarine research and engineering facility is operated jointly by VIMS and the Corps. The new Chesapeake Bay Hydraulic Model to be built by the Corps will further enhance the scientific and practical oceanographic work of Virginia's marine scientists and engineers.

The Institute operates a fleet of three medium-sized (50′–90′) vessels and a score of small ones.

Several other academic institutions in the state either have individuals or groups of scientists interested in oceanography and marine problems. Included are the School of Engineering and the Departments of Geology and Geography of the University of Virginia; the College of Engineering and the Departments of Geology and Biology and Forestry and Wildlife of Virginia Polytechnic Institute; the Departments of Biology, Chemistry and Geology, of the College of William and Mary; the Department of Biology of the University of Richmond; the Department of Biology at Virginia State College in Petersburg; the Department of Biology of Frederick College; various departments of the Medical College of Virginia, Madison and Longwood Colleges.

Some schools are developing separate facilities and programs in marine science. For example, Hampton Institute has expressed a desire to develop a departmental program and Old Dominion College of Norfolk has recently established an Institute of Oceanography with its own laboratory and boat. It is certain that others will be involved. This selected list of institutions which have persons with marine interests and capabilities is not exhaustive, but does indicate that there is considerable interest and capability in marine science and related activities throughout the academic institutions of the Commonwealth.

Private research institutions and industry have been active in developing programs relevant to the marine environment and its problems. The Virginia Institute of Scientific Research of Richmond has worked on corrosion chemistry. Woodward Research Corporation of Herndon, Virginia, conducts biological studies on a contract basis. Atlantic Research Corporation of Northern Virginia also does contract instrumentation and biomedical and microbiological development work. The two largest industry efforts in oceanography or related fields known to the author have been pursued by the Newport News Shipbuilding and Dry Dock Company, which has conducted global exploration of submarine mineral deposits using its own research vessel *Prospector*, and Reynolds International, Inc., whose program to develop and operate the deep submergence vehicle

Aluminaut is widely known. There are undoubtedly other private and industrial capabilities in Virginia and Maryland. Near Annapolis, the Undersea Division of Westinghouse with its DEEPSTAR series of deep submersibles is another developer of engineering products for oceanography.

Considerable engineering and scientific talent in oceanography and related fields is present in the many federal establishments in the Commonwealth and nearby Washington and Maryland. Among those in Virginia are the Naval Weapons laboratory at Dahlgren, and in Norfolk, the Land of Sea Interaction Laboratory (LASIL) and the Atlantic Ship Base, both of the Environmental Science Services Administration (ESSA). In addition, the U.S. Navy Weather Research Facility (Norfolk) and the Langley tow tank facility of the David Taylor Model Basin on the Peninsula are oriented toward marine research. Allied technical capabilities exist at NASA, Langley Field and NASA, Wallops Island. Cooperative research programs are underway or have been conducted between VIMS and both units of ESSA as well as with the Navy Weather Research Facility and NASA, Wallops.

Among the noteworthy non-military research and development projects that have been carried out in Virginia waters by Virginia-based institutions are the following studies (mostly drawn from VIMS' files) :

1. Temperature and salinity distribution and circulation of Continental Shelf waters designed to develop better understanding of the factors involved and, if possible, capability of forecasting waves and currents. (The scientific and practical import of this project is obvious since military activities, boating, movement and survival of fishes, beach erosion and many other important features are directly dependent upon circulation of inshore oceanic waters.)
2. Circulation of tidal and estuarine waters of Chesapeake Bay and its tributaries. (Tidal and estuarine waters figure significantly in all maritime affairs. Hence, the significance of this work to industry and public welfare is clear.)
3. Chemistry of estuarine and shelf waters, with emphasis on the effect of man's activities on the natural environment.
4. Fate and role of radioactive particles in marine waters and sediments and organisms (significant because of the increasing use of nuclear energy in ship and electrical power plants).
5. Distribution and fate of pesticides in marine waters and organisms.
6. Primary productivity and overfertilization of coastal waters.
7. Distribution and abundance of molluscs, crabs and finfishes in relation to natural and manmade factors and to fishing activities.
8. Effects of pollutants on fishery populations.
9. Search for unexploited or underexploited stocks of fishery organisms.
10. Development of techniques for mariculture of oysters, clams, and crabs and other species.
11. Processes involved in beach erosion.
12. Studies of sedimentation in estuarine and coastal waters.
13. Development and use of hydraulic and mathematical models of estuarine and coastal waters in science and engineering.
14. Development of instruments for oceanography and undersea activities.
15. Use of airborne and satellite radiometry and microwave photography in oceanographic studies.

These and other activities in the marine sciences and in public and private management of marine resources have begun to provide a research, development and management capability which will be useful in the future development of Virginia. As a result, Virginia is in the best position that she ever has been to advise, secure or provide services on such practical problems as location of industrial plants; shoreline and water-use proposals; channel, dam and shoreline modification; beach erosion and nourishment; marina location; pollution abatement and avoidance in tidal waters; prediction and improvement of fishery stock; prevention of deterioration of the marine environment and other problems. In developing the various oceanographic capabilities in Virginia, especially those of VIMS, emphasis has been placed on making the results of research available and useful to the state, its industries and people. Obviously, people and industry put greatest demands on marine resources. Therefore, state-supported research should serve both science and the resource users.

THE FUTURE

It is clear that Virginia has many valuable marine resources. It is also clear that these resources are extremely useful and that they will be more widely used. As population and industry, both of which are attracted strongly to the marine environment, grow, competition and degradation will follow and the need for more careful management and use of the marine environment and its resources will increase.

In the future, Virginia must be able to 1) resolve conflicting use problems; 2) prevent degradation and destruction of the marine environment; 3) develop the ability to secure more food from the sea by controlled cropping of naturally produced or "wild" populations and by mariculture or "marine farming"—controlled production of marine organisms—first, for molluscs and perhaps algae, and later for crustaceans and finfish; 4) increase sportfishing yields; 5) use converted seawater to drink, process and cool; 6) increase other recreational areas and uses and restore the quality of the marine environment; 7) wisely set aside those areas of marsh, beach and water which must be preserved for all time; and 8) prevent or reduce destruction of life and property.

These demands will call for greater understanding of the processes and phenomena of the ocean and its tributaries and for development of greater technological and engineering capability. These aims will be accomplished if Virginia is able to continue to provide the capabilities of equipment, personnel and shore facilities which will permit improvement of research and engineering and if efforts are concentrated primarily on the phenomena and problems of the coastal and estuarine waters.

These objectives are clearly within the guidelines established by the General Assembly and Virginia and by the President's Advisory Committee and the National Academy of Sciences Committee on Oceanography. Existing programs and most of those planned for Virginia will contribute markedly to the further social and economic development of the Commonwealth as well as to increasing fundamental knowledge of the sea.

Because of these factors of population and industrial growth in Virginia and of the need for more food, water and minerals from the sea, its shores and floor and for wise placement of factory, farm, home and city, it is clear that further development of oceanography, marine technology and engineering by the Commonwealth and by the federal government and industry is warranted and necessary. It will be vital to the future for the General Assembly to continue to provide support and growth funds for the State's marine science program as it has so wisely in the past. Important also will be increases in the investments of industry, academic institutions and the federal government in oceanography. For the immediate future, severe reductions in federal funds for oceanography appear imminent due to competition with Vietnam, foreign aid, poverty programs and other activities of the national government. However, as these pressures ease, the growth of oceanography and its service to man will undoubtedly rocket because development of ocean resources is vital to the future of the Nation and especially to Virginia.

JAMES RIVER HYDRAULIC MODEL MULTI-PURPOSE MARINE RESEARCH TOOL FOR SCIENCE, GOVERNMENT AND INDUSTRY, PUBLISHED BY VIRGINIA INSTITUTE OF MARINE SCIENCE, GLOUCESTER POINT, VIRGINIA

Inside a hangar-like shed down at Vicksburg, Mississippi is a unique research tool valuable to science, government, and industry. This is the James River Hydraulic Model—a miniature version of Virginia's most important tidal river system. The model was built by Virginia in cooperation with the Norfolk District Engineers' Office and the Waterways Experiment Station of the U.S. Army Corps of Engineers. It is operated jointly by the Virginia Institute of Marine Science at Gloucester Point and the Corps.

Investigators use the model to study the river's "natural" processes under controlled conditions. Tides, currents, freshwater flow, saltwater intrusion, and sediment deposition as they occur in the tidal James are duplicated in it. They also run tests to determine how these processes will be affected by river and harbor

projects before expensive man-made changes actually occur. Thus, scientists learn more about the physical workings of the lower James Estuary. Working with engineers they examine construction and sewage discharge proposals for their possible effects on valuable natural resources. Industrialists with shoreline factories that use water for transportation, waste-removal, cooling and other manufacturing processes examine present river-oriented operations or future developments and determine how these change or are changed by existing river conditions.

The James River Model can be an invaluable aid to Virginia in planning an orderly development of resource potentials throughout the entire tidal basin from Richmond to Hampton Roads—planning which calls for tailoring river and harbor projects so that desirable economic and social advantages may be realized.

A MODEL IS BORN

Nearly fifteen years ago municipal and industrial interests that used the James River urged deepening the 25-foot channel from Hampton Roads to Richmond to 35 feet so larger vessels could navigate upstream. The economics of inland shipping would thus be improved because deepdraft ships could dock at Richmond and Hopewell. Others felt that a deeper channel through the upper tidal James would open new avenues for industrial development in that area.

Few objections were voiced at first. But as time passed, fear arose that this navigation project might have serious effects on the multi-million dollar oyster industry. Oystermen protested that valuable seed oyster beds near the James River Bridge might be seriously damaged or even destroyed. Scientists predicted that physical changes in the estuarine portion of the river would surely result. The Virginia General Assembly delayed approval of the project until a scientific study could determine the various physical and biological effects that would result from channel modification.

As part of this study, scientists from VIMS recommended building a physical scale model of the tidal James to test the proposed change under conditions resembling those in nature. The model would enable them to accurately pinpoint natural conditions before and after deepening.

Funds became available for research on the problem in 1964 when the General Assembly appropriated $300,000 to the Commission of Fisheries (now the Virginia Marine Resources Commission) in Newport News. This included construction of a suitable hydraulic model.

THE MODEL MAKERS

The U.S. Army Corps of Engineers was selected to build and operate the James River Model. It possessed the necessary skill and facilities; furthermore, the Corps contributed about $100,000 toward building costs. The model was built at the Waterways Experiment Station (WES) in Vicksburg, where a dozen other hydraulic models are also housed. (WES is the principal research and engineering study facility of the Corps). VIMS provided bathymetric information (bottom contours), and the necessary oceanographic data (salinity distribution, current speed and direction, etc.) for model construction and verification.

VIMS PROVIDES DATA

The Commission selected VIMS to conduct the necessary research for determining the effect of channel deepening on oyster production in James River. VIMS then initiated a multi-disciplinary research project (labeled Operation James River) that provided information concerning the physical and chemical processes in the James and the effects of these phenomena on the biological activities occurring in the estuarine portion of the River.

In 1967 reports were submitted to the Governor and General Assembly of Virginia stating that tests in the model had revealed channel modification would not seriously affect the oyster industry. The navigation project was approved.

RETAINED BY VIRGINIA

After the Corps of Engineers fulfilled its contract with Virginia for the Channel Study and completed certain studies of its own, the model could have been dismantled. Regulations governing WES allow it to destroy models when there is no longer any need for them. Virginia, however, acted quickly and requested

that the model be kept in operating condition for future uses. The Commonwealth had invested over $400,000 in this experimental facility and VIMS scientists urged officials to retain it for continued use by the State in developing the important James River Basin and by the communities and industries located along the river.

The model was saved. The Corps agreed to a program of joint financing and use by both the Commonwealth and the Federal Government. The model is kept on standby status and VIMS pays monthly rental of $300 to cover costs of maintaining it when not in use. As it has worked out, the model has been in almost continuous operation since the Channel Study was completed in late fall of 1966.

REPRODUCES NATURE IN MINIATURE

The James River Hydraulic Model is an experimental device used by scientists and engineers to duplicate nature in miniature. One horizontal foot in the model equals 1,000 feet in the river; one vertical foot represents 100 feet. Four days in nature are scaled down to one hour on the model; a normal 12½ hour tidal cycle is condensed to only 7½ minutes.

A protective shelter houses the model to avoid local wind effects, dilution from rain, and to allow uninterrupted operation in winter. The model is 550 feet long and 130 feet across at its widest point. The bed is molded of concrete and covers some 25,000 square feet.

The entire James River Tidal Tributary from its fall line at Richmond through Hampton Roads into the Chesapeake Bay and including 200 square miles of Atlantic Ocean is formed in the model. Tidal portions of all major tributary streams are included: the Elizabeth, Nansemond, Pagan, Warwick, Chickahominy, and Appomatox Rivers.

Man-made obstructions that interrupt the river's flow are also built to scale in the model. Replicas of existing piers, bridges, tunnels, and the U.S. Navy's James River Reserve Fleet have been added to duplicate the physical effects of these structures.

Model Scales

Scale	Ratio Model: Prototype
Horizontal Distance	1:1000
Vertical Distance	1:100
Water Velocity	1:10
Discharge Rate	1:1,000,000
Volume	1:100,000,000
Salinity	1:1
Time	1:100

Tides, currents, freshwater flow, saltwater intrusion, and sediment deposition are simulated with known accuracy. An automatic tide control mechanism regulates rise and fall of the water level by alternately filling and draining water in the system. Variable copper "hydraulic resistance" strips duplicate bottom roughness, and they can be adjusted to make currents behave as they do in the river.

Strategically located inflow devices regulate the amount of fresh water introduced. Artificial sea water from a large supply tank is pumped upstream by the simulated tidal action to imitate saltwater intrusion. Gilsonite may be introduced at different points along the model bed to simulate sedimentation and scouring. Dyes may be used to study circulation and simulate introduced chemicals, suspended particles and even, to a degree, planktonic organisms.

Measurements in the model are taken with various instruments. Tidal heights are obtained with stationary point gauges. Current velocities are measured with miniature Price rotating cup meters. Salinity samples are drawn by vacuum into vials through small intakes set in the model at various depths. Sediment grids indicate where silt may be deposited. Time-lapse photography and fluorescence detectors are used in dye diffusion and dispersal studies and in sedimentation and circulation studies.

Because the model reproduces, records, and measures physical factors with known accuracy and precision, scientists and engineers can demonstrate existing conditions of the river or any new condition induced by either man or nature.

SERVES MANY PURPOSES

The James River model is useful to private and public groups on local, state, and national levels. Some recent studies and proposed ones are as follows:

Virginia Electric and Power Company used the model to test the environmental effects of heated effluent from a proposed nuclear power plant to be located at Hog Point in Surry County.

The City of Newport News used the model to help choose one of three possible plans for a proposed fill project at Newport News Point.

The Hampton Roads Sanitation District Commission used the model to help select the best site for a sewage treatment plant outfall.

The Navy used the model to aid in solving navigation channel and berthing area sedimentation problems.

VIMS scientists are using the hydraulic model to test the accuracy and precision of such devices and as an experimental "flume" to develop mathematical models of estuarine circulation.

The Federal Water Pollution Control Administration, VIMS, and the State Water Control Board of Virginia are using the model to study the dispersal and diffusion of pollutants.

VIMS projects a series of tests to study distribution of simulated plankton in the estuarine portion of the James.

The Corps of Engineers plans to use the model to conduct tests relating to spoil disposal and other projects.

USE COORDINATED BY VIMS AND CORPS

The operational responsibility for the Commonwealth's interests in the James River Hydraulic Model was assigned to VIMS by the General Assembly with the concurrence of the Virginia Marine Resources Commission. The model is now a facility of the Institute, and its use is coordinated by formal agreement between VIMS and the Corps of Engineers.

To get full benefit from the model, VIMS and WES have made its uses available to qualified private industries, political subdivisions, state and federal agencies, and scientific institutions. Since a heavy demand is expected, certain conditions have been imposed to maintain an orderly and productive operation—as follows:

1) All use—state, city or county, public or private—must be cleared through VIMS.
2) Schedules will be established by VIMS through consultation with the prospective users and the Corps.
3) Copies of all data resulting from use of the model will be forwarded to VIMS as it is generated. This includes raw data, semi-digested data, and reports of results.
4) All costs of modification, special verification, use, and reporting of model work will be borne by the user. The Commonwealth assumes no responsibility or liability for results.
5) Public users, especially federal and state agencies, will have priority over private users.
6) Studies that will help solve problems of interest to Virginia will also be given assigned preference where possible.

Dr. HARGIS. Several agencies of the State are becoming oriented toward management of the "coastal zone" as are many localities. We are party to the Potomac River Fisheries Commission, an effective interstate body, the Atlantic States Marine Fisheries Commission, and hope to help develop and participate in an effective interstate compact for joint attention to the Chesapeake Bay.

Hence, the "coastal zone authority," either State or interstate, concept is not new at all. The Virginia Institute of Marine Science is the separate State agency responsible for research and service to these State and interstate management agencies and evidence that Virginia is developing a coastal zone laboratory.

I have included an article "Oceanography in Virginia" which also indicates our interest in State support of oceanographic activities.

Several other points, beyond those presented above, might be mentioned. Nothing effective will happen in developing the proposed national oceanographic program without adequate funding. Oceanography is in a fund squeeze. We must maintain an effective balance of basic and applied—definitions vary—research in the marine environment and to do so will require money.

Where funds are short, priorities are necessary. Therefore, projects should be chosen with care. It is my firm belief that realistic priorities can be set and objectives attained. You remember that the Commission's report suggested certain national oceanographic projects and I would suggest that any of those that are going to be considered for funding should be selected in terms of the general need of the United States and of its important marine activities and selected with care, with attention to the long-range and short-range goals or needs of the States and the United States.

Some of these can be identified quite clearly. Preservation of environmental quality and preservation and enhancement of the fisheries are among those.

In developing its suggested budget the COMSER report pointed out that ships for high seas work are costly and accordingly recommended a sizable amount for same in its equipment list for deep sea programs.

In the budget for scientific facilities for the coastal zone laboratories, costs of major equipment figured rather lower. I believe that this differential likely is not justified because the coastal zone laboratories and coastal zone management programs will require extensive and expensive hydraulic scale models, computer systems, automated monitoring and research data acquisition arrays, special vessels and highly specialized physiological laboratories and ecological research devices.

These I am sure will equal or surpass in cost the cost of high seas vessels. In fact, I would expect that needs for funds for the coastal zone research activities would be as high, even higher, than those for deep sea work, in the aggregate, and this would be due to the greater total activity in the coastal zone and the need for more scientific information in a shorter period of time.

A word about an important project. I must confess that I am not unbiased but I do want to indicate to the committee a potential national project, one which is already authorized by Congress and one which wants only adequate money and time to see it accomplished reasonably soon.

That is the Chesapeake Bay hydraulic model and associated technical center that some of your members have been urging for some time. It has been authorized for the Corps of Engineers to carry out in consonance with the States.

Major emphasis in the COMSER report and in congressional actions for the last 5 years has been placed on the "coastal zone" and its estuaries. Model systems—working combinations of hydraulic and mathematical models—and that is what the Chesapeake Bay hydraulic model and technical center would provide—are essential to effective science, engineering and management of major estuarine systems.

Given this emphasis on the "coastal zone," the national importance of the Chesapeake Bay system, the proximity to Washington and the spreading edge of Megalopolis—unspoiled enough to be worth atten-

tion and yet under pressure enough to demand concern—I wonder if it wouldn't be a good idea to devote immediate effort to develop the Chesapeake Bay as a prototype for an effective estuarine management and engineering and research system—a sort of nearby national project—which would serve as a model, useful in many other areas of the country.

Virginia and the Federal Government have cooperated effectively on a management problem—the James River navigation project and we in Maryland can do the same on the Chesapeake Bay. As you probably know there are several research institutions of fair competence on the Chesapeake Bay and we have banded together to form a Chesapeake research council.

We hope to be able to work on this problem. We have been prepared for over a year to do so, wanting only money. A recent advisory on the James River hydraulic model and its uses is included for your interest. In case I can persuade you as to the importance of hydraulic and mathematical models in estuarine management.

In order to avoid ending on this local note, I wish to reemphasize that the Council of Maritime States, Commonwealths and Territories—which, by the way, was not asked to endorse the Chesapeake Bay prototype concept mentioned immediately above—the Commonwealth of Virginia and its Virginia Institute of Marine Science wish to commend the COMSER group for an excellent job and endorse its essential points to the Congress through you. We will all work with you in developing an effective national oceanographic program. Please do not hesitate to call on us.

Thank you.

Mr. Rogers. Thank you, Doctor.

We appreciate your statement very much.

Mr. Downing.

Mr. Downing. Thank you, Mr. Chairman.

Dr. Hargis, I think you have made another significant contribution to the committee on this subject. There are several questions.

The Chesapeake Bay model was authorized by the Congress several years ago. What is the status as of this moment?

Dr. Hargis. The status is "quo". Appropriations sufficient to carry forward the project have not yet been made and, therefore, we are waiting.

Now an advisory group has been appointed by the Governors of the States and by the Federal agencies involved and several meetings have been held.

We had made some preliminary plans and the Baltimore district of the corps has done some planning work and is doing some studies but essentially we are waiting.

Mr. Downing. Do you remember the amount of the authorization figure?

Dr. Hargis. I think the amount ran approximately $6 million.

Mr. Downing. Do you know whether that is to be included in this year's appropriation?

Dr. Hargis. No, sir. It is not.

Mr. Downing. Dr. Hargis, you mentioned the use of the Chesapeake Bay as possibly a national model for this work.

Dr. Hargis. Yes, sir.

Mr. DOWNING. Is there any particular reason other than a local boy as why you picked the Bay over any other body of water in the country?

Dr. HARGIS. Well, this sort of work could be carried forward in any one of a number of major estuaries. However, I think that if called upon to develop the proposal of the project I would say that there are several good reasons. Among them is the fact that the Chesapeake Bay is still relatively undisturbed but it is being disturbed rapidly. It is near Washington, makes a good high visibility project. The National Capital as well as several of the State capitals have had impacts on the Bay itself and we have a fair amount of, a fair concentration of scientific capability. We have planning. The model has already been authorized. We have also the James River hydraulic model with a fair amount of experience and it is a relatively simple system politically as these things go. That is two States involved in the Greater Chesapeake Bay. I think that furthermore, the horses are at the post and we are ready to go.

Mr. DOWNING. Has the James River model been an effective tool?

Dr. HARGIS. Yes, sir; it has. This little brochure that I have added to this if you have a chance to read it, I believe will indicate so. As you recollect the question that came before us was quite practical. That is, would the James River navigation project, the proposal to dredge a channel 100 miles approximately from the Hampton Roads area to Richmond, affect the currents and salinity structure of the James and then, if there would be such physical effects, would they have any influence on the oyster industry which is primarily dependent upon the James River as a seed area.

This model along with the associated studies was authorized by the General Assembly and funded mostly by the General Assembly although with some support from the Public Law 88–309 and the Corps of Engineers.

The answer came out reasonably clearly, using the hydraulic model and all the studies in the laboratory and field that we were able to carry out, that the navigation of the James River Channel would have an effect on the salinity and current structure of the James but it would not be biologically significant in terms of oyster production.

This is one of those times when we were able to within a 3-year period reach a conclusion which was positive, was stated, and was useful.

Mr. DOWNING. But the dredging itself would create some damage to the oyster beds, would it not?

Dr. HARGIS. Yes, direct damage but we judge it would be rather minor and accountable. The James River hydraulic model has been in constant use since our study was done in 1966, and in fact it has been used on pre-site studies, that is location of a nuclear powerplant at Hog Point on the James below Jamestown Island. It is being used by the Federal Water Pollution Control Administration and by the Corps of Engineers in various practical projects that they have concerning pollution and water front development, so that there is no question in my mind that hydraulic models are a necessary and useful tool well worth the investment that we make on them.

Mr. DOWNING. In your statement you seem quite concerned, Doctor, that the States do not have enough authority under the Cosmer recommendations. Is that a fair statement?

Dr. HARGIS. No. I think that it would be perhaps a little better to phrase it this way, Congressman Downing.

That is, that the Commission during its deliberations apparently became aware that the States do have major responsibility in the coastal zone and should be encouraged to assume their responsibilities and in this we concur.

Now, my major concern over the last 4 or 5 years has been that as we talked about a national oceanographic program we should be sure that it is a national rather than a Federal oceanographic program—which this committee the Subcommittee on Oceanography has itself urged, and that in the past the States have not, either through their own neglect or for one reason or another, expressed an effective concern and involvement in the development of a national oceanographic program. I hope that this will change.

Mr. DOWNING. I have one last question.

This is really not in connection with the statement. The Navy as you know is thinking about getting rid of 10 nuclear submarines. It has been suggested that one of them could be turned over to the NOAA for oceanographic use. Does this sound feasible to you?

Dr. HARGIS. Well, I think that you have me a little bit out of my element. We are primarily interested, of course, in the Continental Shelf and so forth but I would say that the use of submersibles in oceanographic work is developing. I would think that any such proposal as this would have to be examined extremely carefully in terms of its costs and payouts.

There may be some submersibles that have been developed that would be much more useful and perhaps less costly. So that, with the note that I am not an authority on the subject and, therefore, my statement should be considered as such, I would say that we ought to look at any such proposal quite carefully.

One problem with operating surface vessels and subsurface vessels is that they are quite costly and what I think we all must guard against is that the programs don't become wagged, the tail doesn't start wagging the dog and the hardware wagging the operation.

Mr. DOWNING. Thank you very much, Dr. Hargis.

Thank you, Mr. Chairman.

Mr. ROGERS. Mr. Mosher.

Mr. MOSHER. Dr. Hargis, this morning you have devoted considerable favorable attention to the concept of coastal zone authorities and coastal zone laboratories as recommended by the Commission. As you see it, does the Great Lakes area have a useful and proper role in those concepts?

Dr. HARGIS. Yes, sir.

As a matter of fact, I should have indicated that at the meeting of the Council of Maritime States, Commonwealths and Territories the Great Lakes States were represented and they are considered to be in this instance maritime States.

So that I think they do, yes, definitely.

Mr. MOSHER. By definition I think Congressman Ruppe and I feel strongly that they should be considered maritime States.

Dr. HARGIS. Yes, sir.

Mr. MOSHER. Are the States of Ohio and Michigan represented in this Council?

Dr. HARGIS. Yes, sir. I could read the list.

Mr. MOSHER. You don't need to.

Dr. HARGIS. There were several of the Great Lakes States represented by gubernatorial representatives.

Mr. MOSHER. You have only made very fleeting reference to the sort of the heart of the Commission's proposal, the proposed creation of NOAA, the National Oceanographic and Atmospheric Agency?

Dr. HARGIS. Yes, sir.

Mr. MOSHER. I am interested in your paragraph on page 5 which begins with "Every effort should be made * * * to keep waste and unnecessary duplication" and you end that paragraph by saying, "However, we must avoid the easy option of unnecessary or unjustified replication or of reorganization and renamings which accomplish little."

Is there any implication in that sentence that you think that NOAA would be an unnecessary and really meaningless reorganization?

Dr. HARGIS. No, sir. I think that I should clarify this by saying that what I wanted to stress is that the establishment of a new agency without the necessary operating instructions, without the necessary organizational arrangements and without the necessary long-term commitment in terms of finances will not accomplish what I believe the objectives of Congress would be and, therefore, these things must come along with any reorganization that is brought about.

Mr. MOSHER. I certainly hope that all of us would agree with that and I certainly believe that that was the Commission's intent. A mere reshuffling of the agency boxes into a new organizational structure or chart and then just allowing them to continue to do what they are now doing would accomplish little, to use your phrase, and would be unfortunate.

But I am assuming that the Commission itself intended and I would assume that any action on our part or in the Administration's part which would reorganize would be with the idea that the very essence of the new organization would be a much broader reorganization and much greater impetus and hopefully with much better financing than would be represented merely by the present agencies that would be brought into it.

Dr. HARGIS. Yes, sir.

Mr. MOSHER. You would agree that this would be important?

Dr. HARGIS. Yes, sir.

Mr. MOSHER. And you do in general favor the concept of NOAA?

Dr. HARGIS. Yes, sir. These were my instructions.

Mr. ROGERS. Mr. Karth?

Mr. KARTH. No questions, Mr. Chairman.

Mr. ROGERS. Mr. Pelly?

Mr. PELLY. I would like to commend you, Dr. Hargis, for a very fine contribution.

Dr. HARGIS. Thank you.

Mr. PELLY. I also want to commend you for your answer to the question of my colleague, Mr. Downing, with regard to the possible use of a nuclear submarine. I can't imagine anything that would be more expensive to operate or probably more difficult to transfer to some scientific purpose. Surplus equipment can be very helpful and at the University of Washington in my district we lease for possibly a dollar

a year a surplus naval vessel which is used for offices and research work and it is very helpful at very little cost however I can't conceive of using a nuclear submarine.

In view of the technicians required and the problems involved in operating such a submarine, it seems to me that those who are trying to develop scientific knowledge would be overwhelmed by the technical aspects of running the vessel.

I think you have made a very fine statement and I appreciate it very much.

Dr. HARGIS. Thank you. I am sure if I might comment here that the members of the subcommittee are aware that the oceanographic community is facing rather difficult times now in terms of operating ships. One reason, of course, is the high personnel requirements that some ships have particularly conversions and the increasing cost of labor.

So we are faced with some problems along the lines of operating major facilities.

Mr. ROGERS. Mr. Hanna?

Mr. HANNA. No questions.

Mr. ROGERS. Mr. Ruppe?

Mr. RUPPE. I have no questions, but I would like to thank you for a very fine statement.

Dr. HARGIS. Thank you.

Mr. ROGERS. Counsel?

Mr. DREWRY. Dr. Hargis, you are the first witness we have had so far who has brought in the State aspect of the thing as to the Commission report and the overall program. I think it would be useful if you could implement what you have already given us by submitting a list of those who make up the Council and any other materials you might have relating to it.

It is not going to be easy particularly because of the number of individuals and entities and communities and theories involved but that also is one of the most important aspects of the total picture and I think the more information we can have on it the better our record will be.

Dr. HARGIS. Yes, sir.

Mr. DREWRY. Thank you, Mr. Chairman.

(The information follows:)

A RESOUTION ADOPTED BY THE (FLORIDA) CONFERENCE

The Steering Committee suggests the following goals, objectives and courses of action are related to the establishment of a more effective and suitable role for the maritime states, commonwealths and territories in interstate and national marine affairs.

The committee recognizes:

(1) The responsibilities of the Federal Government in relation to efforts involving the total national maritime interest:

(2) The responsibilities of individual maritime states, commonwealths and territories to develop, regulate and manage the resources of their coastal zones, and their role as bases of operations for offshore activities.

(3) The necessity for coordination of state and federal activities within their respective responsibilities, because of the contiguity and interaction of respective state-federal responsibility.

(4) The necessity for multi-state participation in the resolution of problems common to the maritime states, commonwealths and territories:

(5) The probability of early Congressional consideration and action in relation to recommendations and findings made by the President's Commission on Marine Science, Engineering and Resources, and the need for maximum state participation in the development of any resultant legislation.

In consideration of the foregoing, we recognize the need for a forum to provide continuing dialogue and to establish a means of achieving coordinated state attention to these and other matters which may hereafter arise. We recommend the creation of a "Council of Maritime States, Commonwealths and Territories". Its purpose will be to provide a means for communications about and resolution of problems common to the maritime states, commonwealths and territories in such specific areas and only to such an extent as may be determined from time to time by the membership.

These areas may include:

(1) Provision of a common forum and voice in matters pertaining to use and development of common marine resources:

(2) Establishment of a proper balance of responsibility and authority between the Federal Government and the maritime states, commonwealths and territories:

(3) Consideration of problems regarding establishment of proper lateral, inland and territorial boundaries:

(4) Avoidance of unnecessary and wasteful duplication in state, regional and federal maritime programs:

(5) Provision for communication between and among the states, commonwealths and territories on maritime matters:

(6) Participation by the states, commonwealths and territories in formation and conduct of the developing national oceanographic program, and

(7) Establishment of means to assure adequate funding of marine related programs on a continuing basis.

As interim steps, we propose: (a) that the delegates report these findings to their respective Governors: (b) that the Honorable Claude R. Kirk, Jr., Governor of Florida, be requested to forward copies of this document to all maritime states and territories not here represented: and (c) that there be another meeting of all interested maritime states and territories for further discussions upon the call of a committee consisting of the representatives of Virginia, Louisiana, Alaska, Florida, Maine, Michigan and California.

NOTE: For purposes of sentence structure, the words "state" and "states" occasionally appear in the foregoing. In each instance, the intent is to include also "commonwealths" and "territories."

The statement representing the views of the official representatives was unanimously approved the morning of November 23, 1968, by representatives from:

Alabama	Mississippi
Alaska	New Jersey
California	New York
Florida	North Carolina
Georgia	Oregon
Louisiana	Texas
Maine	Virginia
Maryland	Wisconsin
Michigan	Virgin Islands
Minnesota	Puerto Rico

Mr. ROGERS. Dr. Hargis, we appreciate your testimony.

I was interested in your statement that it is difficult to operate these research vessels and certainly we are concerned with our development of submersibles. I have been concerned that there has been a reduction in the budget for moneys for submersibles from $4 million down to $1 million.

In other words, they have reduced it $3 million. What is your feeling on that?

Dr. HARGIS. Well, my general opinion would be that it is unfortunate, it would be unfortunate if the development of specifically designed submersibles would be delayed by a lack of support.

Mr. ROGERS. The use of submersibles, you see, will be limited. We have had some 1,600 to 2,000 requests for use of submersibles that would have been funded or partially funded out of this money. That is reduced.

Now, has your organization had a chance to look into that and register some protest to this approach?

Dr. HARGIS. No, sir; we have not, Congressman Rogers.

Mr. ROGERS. Do you think you could review the situation and let us know your feelings as an organization?

Dr. HARGIS. I think that we might. I can contact some of the other members of the Council, the executive committee, and see what might happen. As you know, Mr. La Cerda and Mr. Dover and a few of the members of the Florida Commission on Marine Science and Technology have been involved in our program and so I would suspect that we would get some input from them.

Mr. ROGERS. I would hope that you would give some expression to this because I think that, unless the oceanographic community makes itself heard, then the administration will not be as impressed with what we need in certain areas and I would hope your organization could respond.

(The information will be supplied at a later date.)

Mr. ROGERS. I notice, too, that, of course, you stress the coastal zone.

Dr. HARGIS. Yes, sir.

Mr. ROGERS. And the coastal laboratories. I presume you feel that this is a responsibility of the States?

Dr. HARGIS. Yes. I definitely do.

Mr. ROGERS. Except for perhaps some funding from the Federal Government?

Dr. HARGIS. Funding and some urging and support and perhaps even establishing of some models to go by, but I have been convinced for a long time that the States themselves should have greater involvement in both support of research and in development of effective management capabilities.

Mr. ROGERS. Would it be possible for you to furnish to the committee the State budgets for the development of oceanography from your member organization?

Dr. HARGIS. I had thought about the possibility of getting such a listing together and I will see if I can't do something over the next month or so.

Mr. ROGERS. If that is possible I think it would be helpful to the committee to know what the States are currently spending and what they project for their next fiscal year.

Thank you very much. Your testimony has been most helpful and the committee is always pleased to receive your remarks.

Dr. HARGIS. Thank you, sir.

(The information will be submitted to the subcommittee as soon as it is compiled.)

Mr. ROGERS. Our next witness is Dr. Bruce Halstead, Director of the International Biotoxicological Center, World Life Research Institute, Colton, Calif. Dr. Halstead, we are pleased to receive your testimony at this time.

(The biography follows:)

BIBLIOGRAPHY OF BRUCE W. HALSTEAD, M.D., COLTON, CALIF.

Birthplace: San Francisco, California, March 28, 1920.

Married: 1941. Wife: Joy Arloa. Children: 6.

Director, World Life Research Institute, Colton, Calif. 92324; Phone: 714/825–4773.

Academic Record: 1941, A.A., San Francisco City College; 1943, B.A., University of California (Berkeley)—Zoology; 1948, M.D., School of Medicine, Loma Linda University.

Military Record: U.S. Army (Pfc), Enlisted Reserve Corps, Army Specialized Training Program 4 August 1942 to 18 August 1946; U.S. Public Health Service (Asst. Surgeon)—21 July 1947 to 20 July 1952; U.S. Navy (Commander), Medical Corps, USNR–R—1 January 1957—present; U.S. Marine Corps Medical Officer), 4th Force Reconnaissance Co., Force Troops, FMF, U.S. Marine Corps, San Bernardino—14 Sept. 1959–present; Consultant in Global Medicine, U.S. Naval Medical School, National Naval Medical Center, Department of the Navy, 1968—; Lecturer, Biotoxicology, School of Aerospace Medicine, U.S. Air Force, Brooks Air Force Base, Texas.

Professional Experience: 1935–43, Research Assistant, Department of Ichthyology, California Academy of Sciences, Golden Gate Park, San Francisco (part volunteer, part paid); 1943–44, Instructor in Biology, Pacific Union College, Angwin, California; 1944–47, Student in medicine, Loma Linda University, Loma Linda, California; 1947–48, Interned, Marine Hospital, U.S. Public Health, San Francisco, Calif. (Asst. Surgeon); 1948–58, Chairman, Section of Natural Products (Biotoxicology), and Assistant Director, School of Tropical and Preventive Medicine, Loma Linda University. Also, Associate Professor, Department of Preventive Medicine, Loma Linda University; 1950–51, Instructor in Ichthyology, La Sierra College, La Sierra, Calif. (while still on staff at LLU); 1957–58, On leave of absence from LLU and entered active military duty—USNR; Instructor in Tropical Medicine, Division of Preventive Medicine, U.S. Naval Medical School, Bethesda (rank Lt., later LCDR—3 February 1957–10 June 1958); 1958, Returned to Loma Linda University, Resigned October 1958; 1959–present, Director, World Life Research Institute, Colton, Calif.; 1964–present, Research Associate in Ichthyology, Los Angeles County Museum; 1964–67, Research Associate, Lab. Neurological Res., School of Medicine, Loma Linda University, Los Angeles County General Hospital; 1964–summer, Instructor in Ichthyology, Walla Walla College Marine Biol. Station; 1968–present, Lecturer, Department of Biology: Pacific Union College, Angwin; 1968, Lecturer, Medical Center, School of Medicine, University of California, San Francisco, Calif.; 1968, Occasional lecturer, University of Southern California, School of Medicine, Graduate School, Los Angeles, Calif.; 1968, Lecturer, School of Public Health, Loma Linda University; 1969, Lecturer, School of Pharmacy, Oregon State University, Corvalis, Ore.

Honorary Positions: Editorial Consultant, *Journal of the American Medical Association*, 1956–58; Editorial Staff, Excerpta Medica, International Medical Abstracting Service, Amsterdam, Holland, 1959–present; Member, Board of Directors, American Association of Fish and Game Biologists, 1962; Member, Editorial Council, *Toxicon.* Pergamon Press, 1962–present; Member, Board of Advisors, National Assoc. Underwater Instructors, 1962–; Member, Board of Directors, International Underwater Enterprises; Member, Board of Directors, International Botanicals, Inc.; Editorial Board, *Clinical Toxicology*, 1966–present; Co-chairman, Biology Committee (Drugs from the Sea) Marine Technology Society.

Consultantships: 1955, George Washington University, U.S. Air Force contract (AF18(600)–1190)—Air Force Survival problems; 1958, National Institutes of Neurological Diseases and Blindness, U.S. Public Health Service; 1962–67, Pitman-Moore Co., Dow Chemical Co., Indianapolis, Indiana—new drug development; 1962–present, W. J. Voit Rubber Corporation—testing SCUBA gear: 1963–present, Marine Colloids, Inc.—seaweed research; 1964, Marine Technology Group, North American Aviation, Columbus Division, Miami, Florida—oceanography; 1964, Autonetics Corporation, North American Aviation, Inc., Anaheim, California—oceanography; 1965, Member, Special Study Section on Biotoxicology and Natural Products, Research Grants Review Branch, Division of Research Grants, National Institutes of Health; 1967, Battelle Memorial Research Institute; 1968, Biotoxicology, Global Medicine Program, School of Aerospace

Medicine, U.S. Air Force; 1968, World Health Organization of the United Nations, Marine Intoxicant Informal Committee, Geneva, Switzerland; 1969, Member, Joint IMCO, FAO, UNESCO, WMO group of experts on marine pollution, Food and Agriculture Organization of the United Nations; 1969, Marine Aquaculture, Aquarium Systems, Inc., Wickliffe, Ohio.

Membership in Scientific Societies: American Association for the Advancement of Science—FELLOW; American Institute of Biological Sciences; American Microscopical Society; American Society of Ichthylologists and Herpetologists; American Society of Limnology and Oceanography; American Society of Pharmacognosy; American Society of Tropical Medicine and Hygiene; California Academy of Sciences—FELLOW; Hollywood Academy of Medicine (Honorary); International Society of Toxinology—FOUNDING FELLOW; Marine Technology Society; New York Academy of Sciences—FELLOW; Royal Society of Tropical Medicine and Hygiene—FELLOW; Royal Zoological Society of New South Wales; San Francisco Aquarium Society; Sigma XI; Society of Experimental Biology and Medicine; Society of Systematic Zoology; Washington Academy of Sciences; Western Society of Naturalists; Member—Great Barrier Reef Committee of Australia; National Geographic Society; International Oceanographic Foundation; Academia Nacional de Medicina de Buenos Aires—Miembro Correspondente Extranjero.

Honors: President, Senior Class, School of Medicine—1946–47; Listed as: Among 12 outstanding young men in California, by California Junior Chamber of Commerce, 1955; Listed in: American Men of Science; Leaders in American Science; Who's Who In The West.

Foreign Travel: Africa—Egypt, Libya, Morocco (Red Sea); *Asia*—India, Japan, Pakistan, Pescadores Is., Saudi Arabia, Taiwan, Turkey, Thailand, Hong Kong; *Europe*—Austria, Belgium, Denmark, England France, Germany, Italy, Greece, Lichtenstein, Monaco, Norway, Portugal, Spain, Sweden, Switzerland, USSR, Hungary, Czechoslovakia, Rumania, Estonia, Poland; *North America*—Baja California, Canada, Cuba, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, Panama, San Benitos Is., Alaska; *Oceania* (*Islands*)—Caroline, Cocos, Galapagos, Hawaiian, Johnston, Line, Marianas, Marshall, Palmyra, Philippine, Phoenix, Ryukus, Wake, French Polynesia; *South America*—Colombia, Ecuador, Peru; *Australia.*

STATEMENT OF BRUCE W. HALSTEAD, M.D., DIRECTOR, WORLD LIFE RESEARCH INSTITUTE, COLTON, CALIF.

Dr. HALSTEAD. Thank you, Mr. Chairman.

Mr. Chairman, gentlemen of the committee, I would like to direct my remarks specifically to the subject of biomedical oceanography and more directly to the line item in the recommendation of the Commission reports for the establishment of a National Institute of Marine Medicine and Pharmacology.

With your permission I would perfer not to read this document to you but rather to try and comment on certain sections here that I believe are pertinent to any legislation that might be developed in the future regarding this subject.

Mr. ROGERS. That will be acceptable to the committee.

Dr. HALSTEAD. I would like to touch for a moment on the subject of the definition of biomedical oceanography because in the mind of many people this represents a new departure from the old line concepts of oceanography. Specifically we are dealing with those areas that relate to the development of new drugs, the utilization of biochemical resources, a better understanding of our environment in terms of dangerous marine animals, in other words, environmental hazards that relate directly to the man-in-the-sea program, and when I say "man in the sea," I am thinking of "man in the sea" in a very broad sense of the term rather than the project as referred to by the Navy.

We are thinking also of the use and problems relating to diving physiology, hyperbaric medicine. These are the areas that we are trying to point up when we use the term biomedical oceanography.

I think we can illustrate this a little more graphically if I can show these pictures and if the gentlemen are ready with the projectors. I would like to show you this first film on some of the hazards that we encounter in the area of toxic marine organisms.

Most of this material has now been documented based on what now amounts to a 25-year study. This study was under the sponsorship of many different Federal and private agencies.

I have with me this morning two of these volumes on "Poisonous and Venomous Marine Animals of the World" which I wrote. There is a third volume that will be out late this fall on the subject of poisonous and venomous marine animals. Please keep in mind that this is only one segment of the overall field of biomedical oceanography. These volumes contain over 3,000 pages of documentation on one aspect of biomedical oceanography.

Mr. ROGERS. Excuse me.

Come ahead and set up your projectors and the doctor will proceed with his testimony as you are setting it up.

Dr. HALSTEAD. I would like to point up the relationship that exists between what we might term biochemical agents, nutrients, marine pharmaceuticals, and toxins.

When we talk about nutrients, when we talk about marine pharmaceuticals, and when we talk about toxic agents, basically we are talking about biologically active products.

In other words, we are talking about a substance that either when ingested or when injected produce some sort of a reaction, some sort of an effect in a human or an animal. If we look at the subject of drugs, we find that a drug is really not effective and it is really not of any commercial value unless this drug does have some sort of biological activity.

When we have a therapeutic agent in sufficient concentration—we can take almost any of our antibiotics as an example of this—we can actually produce a toxic reaction.

There is a direct relationship between drugs on the one hand and toxic substances on the other. So when we undertake a fundamental study in the area of marine biotoxicology, biological poisons produced by marine organisms, we actually have a groundwork as it were for the entire area of marine pharmaceuticals.

We also find that there is a relationship between pharmaceutical products, toxic agents, and foods from the sea because in some instances, as you will see in this first motion picture, some of the organisms that we would like to use as food and which are usually edible under certain circumstances may become very toxic and in this first film you will see an example of this.

Here is a red snapper, a valuable food fish, *Lutjanus vaigiensis*, a member of the snapper family.

In this case we had a fish which, because of its food habits and because of the environmental conditions that existed in this particular island area, within a very short period of time became violently poisonous.

If we may have the lights out, I would like to show you this film. This red snapper is only one of a large number of fish that are members of this family. I think that if anyone were to catch this fish either in a commercial haul or by hook and line they would recognize this fish by its outward appearance to be a valuable food fish.

In this case we found many of these red snappers to be very toxic in the area of the Line Islands and specifically Palmyra Island, 960 miles due south of Honolulu. We took a portion of this fish and fed it to a cat, and you can see the reaction on the part of the cat.

If you look over the human clinical case histories that have appeared over several centuries of time you find that you get a comparable reaction in humans.

I think the pertinence of this problem at the moment is that we find ourselves launching a major effort now in trying to develop food resources on a vast scale in many parts of the world.

We find that there is getting to be increasing fisheries operations in tropical regions of the world. As we move into the Tropics we find that we also encounter many toxic agents that are not found in temperate latitudes either in the north temperate or south temperate seas.

Here we are in a group of Line Islands that are just a few degrees north of the Equator. We used kittens for the simple reason that these cats react in many ways like humans.

In this particular cat you see a loss of the righting reflex. You take your own cat and try that, and you will see that the cat will rapidly right itself. There is a loss of some of the deep and superficial reflexes and a certain number of these animals, as with humans, die of a respiratory paralysis.

In the distribution of the poison you cannot predict either the edibility of the fish or the part of the fish that may be affected in terms of toxicity. You will notice that we have tested various sections of the fish.

In this latter case we are taking the intestines and feeding it to the cat. In this next cat which became severely poisoned and did not recover you see a good example of a fatal intoxication. You will notice that this cat had heavy abdominal respiration, is breathing with great difficulty, has a complete loss of motor control, and can no longer control its legs; we also see this in a human.

You may turn off the projector and go to the next film.

As we start to map out the distribution of poisonous marine organisms we find that it becomes a serious problem in certain select island areas particularly of the tropical Pacific islands.

We find it is also a problem in many parts of the tropical Indian Ocean. It is a problem to a lesser extent in the Mediterranean. It is also a problem as the Soviet scientists have demonstrated in many different parts of the tropical Atlantic, and to a less extent in tropical West Africa.

In trying to develop and utilize our fisheries' resources in the future we are going to have to take a very careful and critical look at the subject of edibility which in the past has been largely neglected for the simple reason that most of our commercial operations have not been tropical but have been in temperate zones.

However, the products that we are talking about produce adverse effects. They are toxic agents. I would now like to discuss the positive

side of these substances and point out that many of these same products are also potentially useful pharmaceutical agents.

They are agents that may have application, rather broad application to various aspects of industry. We find that some of these materials are antibiotic in nature, some have antiviral properties, some are fungicidal and are believed to be potentially useful in trying to treat some of our more serious systemic fungal infections.

We find that some of these materials have general effects. Some of them are psychopharmacological agents affecting the mind. Some of these drugs may be useful in the future in treating mental disorders. We have found antitumor effects, and today we see the National Cancer Institute, for example, beginning to screen some of these compounds in search of antitumor agents.

However, in entering this field of research we find that we do not have at the present time the necessary governmental framework to really get into this subject in depth.

I would like to show you one other film and in the meantime while we are preparing to do this I would like to pass around these photo transparencies that will show you what happens when some of these poisons are injected.

These are photos of two corpses. One is the photograph of the arm of a 4-year-old child that was stung by a sea wasp. This particular creature is a jellyfish scientifically known as *Chironex fleckeri.*

It is believed to be the most deadly venomous organism that lives in the sea. The father was holding this child in approximately 3 feet of water and trying to teach the little boy to swim. The child suddenly cried out in extreme pain.

The father rushed the child over to the beach and started to apply sand in order to brush off the tentacles of the jellyfish; the child died about 35 minutes later.

The corpse of the 10-year-old boy was a boy that was stung in the same geographical area, and I am talking about the area of Cairns in northeast Australia. He was swimming and he died within about 10 minutes from the same species of jellyfish.

These are very dramatic examples of many different types of stinging organisms that we have; at the present time we still do not know anything about either the chemistry or the pharmacology of the poisons, nor do we have any basic information on the ecology, in other words, the environmental relationships, under which conditions these organisms appear, and when, where, and how you are likely to encounter them.

I want to point out to this committee that I think that this information is very pertinent as we begin to pursue our man-in-the-sea program. When we begin to discuss our global capabilities of this program we may have ever so much information on closed ecological systems, as to how you maintain a man in diving gear or a submarine at a certain depth, but when you begin to talk about environmental operations you are talking about something else, because, in this instance, we do not have controlled environmental conditions. I think that this points up some very pertinent problems and deficiencies in our present knowledge.

In this next film we are dealing with Minamata disease. This is still another aspect of the overall field of biomedical oceanography.

In the problem of Minamata disease this was a situation that started about 1953 in Minamata down in the southeastern portion of Japan on the island of Kyushu. I was called in by the National Institute of Neurological Diseases and Blindness. We went down there because a number of people had been involved; at that time about 83 persons had ingested various types of marine organisms, ranging from seaweed to shellfish, crabs, various fish, et cetera, and these people were developing a wide array of neurological disorders.

Some of them were lisping; some of them lost their motor coordination. Some of them were suffering from blindness. Before they had finished approximately one-third of them died. In the early stages of this study we were unable to determine what actually took place.

Japanese scientists spent a great deal of time and effort on this problem. Finally it was determined that there was a large chemical and fertilizer plant that was located on the outskirts of town, and it was producing a toxic effluent of some type.

If you look on a map it seems that there was a peninsula that extended out from this fertilizer plant. To the north was the open sea and to the south was a bay that had a restricted water circulation. They had a long effluent line that extended from the plant to the open sea.

The effluent line through which they discharged their industrial wastes became somewhat of a problem because of maintenance, and so they decided to reduce the length of the line by having it empty into Minamata Bay.

When they did this with the restricted circulation of the bay the pollutants began to build up very rapidly. The line was shifted about 1950 and by 1953 they were already beginning to pick up cases of outbreaks of Minamata disease in which there was massive destruction of the central nervous system of these victims.

As we got into this problem, and when I say we, I am speaking about everybody involved over a period of about 10 years or more, it was finally determined that the causative agent was an organic mercurial compound, an industrial waste product which, at the time it was being dumped, apparently went by undetected. They did not realize they were dumping a highly toxic agent into Minamata Bay.

The significance of this situation is this: That here was a manmade contaminant that came from an industrial plant that was very vital to the local economy of the people of Minamata.

But this very important industrial development was at the same time causing death to these people and while it was producing an income on the one hand it was destroying a valuable marine resource on the other.

Just last November I participated with the World Health Organization in a series of meetings in Geneva to discuss some of these problems. Today we see this same Minamata problem taking place in the North Sea, specifically in the country of Sweden, and elsewhere.

We see other types of contaminants being produced on an enormous scale. I want to point out that some of these contaminants, and I am talking about industrial toxic chemical substances, become intimately involved in the marine organisms of these polluted waters and we find that they are involved in the entire food web as it were so that we see

the involvement of marine plants, invertebrates, micro-organisms, fish, and finally the involvement of man.

When Minamata disease once starts in a human, it is completely irreversible. We can change our legislation but we cannot change the disease in an individual. There is nothing that therapeutically can be done about it.

Furthermore, we have contaminated our environment to the point that we have for at least an extended period of time an irreversible situation. So I say that we are dealing with some very serious problems when we talk about pollution that go beyond the visible destruction of the environment, as in the case of an oil spillage such as we recently had in Santa Barbara.

In this next film I can show you what happens in a human. This little boy had picked up what appeared to be an edible crab.

He took the crab home and ate it, later it was observed that when he went to school he was unable to write on the board. He had extreme difficulty in trying to button his coat. He finally had problems in walking a straight line. But he was a mild case and this boy fortunately recovered.

The insidious part about this problem is that these clinical developments usually arise long after the time where you can really do something about them.

What I am trying to say is that we do not have an adequate monitoring system in marine environmental toxicology.

When we fail to have an effective monitoring system—and may I add that we do not have one here in the United States—these things can get out of hand and finally result in disastrous situations like this.

This is a mild case. You can see the boy having a great deal of difficulty trying to write on the board. We have also had recent reports from Sweden where if the toxic effluent continues at the present rate we will soon approach such toxic limits that it will no longer be possible to conduct commercial fishing operations in certain parts of the North Sea.

This is a lady that was mildly affected. You can see her going through this test trying to touch the finger of the doctor. You can see that she does it with some difficulty.

The lady recovered. This woman, as I recall, was involved in eating fish. Again, these are commercial fish species that are consumed and sold in the local markets there in Japan.

In the next case, which I think is one of the worst, the man that you see in bed did not recover. You will notice that there has been a complete muscular wasting. This victim died shortly after the picture was made, and you will observe what takes place when he drinks just a few spoonsful of milk.

He undergoes a very severe diaphragmatic spasm and at times violent convulsions.

May we have the projector off and the lights back on, please?

Mr. Chairman, I showed these pictures for the purpose of trying to give you a visual concept of the definition of biomedical oceanography, and if I may, I would like to comment on some of the other points in my presentation which I believe are important to your committee.

One of the topics that I think we are really concerned with here is the subject of the international scope of the problem. We have talked in U.N. circles, in W.H.O., F.A.O., and elsewhere about many of these problems. We find out that they are not restricted to any nation.

The pollutants and the toxicity problems of one nation become the problems of other nations. It is not realistic to isolate any segment of biomedical oceanography thinking that this is merely a national problem.

These are international problems, and I strongly urge an international cooperative effort with as many different nations as possible in order to get to the heart of some of these critical matters.

We are also recommending here, Mr. Chairman, the use of a systems management approach. I believe that our past and present grant-in-aid system in many ways has been very fruitful. I am not here this morning to try to condemn it. I am trying to point out, however, that I think that there are certain elements of it that are not conducive to developing a strong national problem in biomedical oceanography.

If NASA was to use the present system of grants-in-aid as we utilize it in, the National Science Foundation, or the National Institutes of Health, et cetera, I doubt very much that they would be getting to the moon within the next few decades because our present grant-in-aid system leaves too much up to the whims of the individual investigator who may be extremely knowledgeable about the hind leg of a toad or know a lot about a particular segment of molecular biology and have missed completely major facets of our national program and our international requirements.

I think we have to develop certain national priorities. I believe we have to develop strong national leadership and to establish national goals. We need panels of experts that can help to establish some of these goals, and this must be done on a realistic basis that is going to meet some of our national needs.

Whereas our existing grant-in-aid program has its place, I believe that when we talk about biomedical oceanography—and I can add to that the rest of the field of oceanography—we need a systems management approach that can be developed on a highly coordinated basis developing national goals and national priorities.

I think that there is a need for a biomedical coordinating committee. I have already indicated that in my written presentation and I don't think I need to comment on that further.

I would like to get to the matter of the establishment of a National Institute of Marine Medicine and Pharmacology. The question has been raised in the past, Aren't we establishing a rather large institution to take care of a rather narrow segment of business?

I would like to point out that it is quite the opposite. First of all the business of biomedical oceanography is the type of thing that is everybody's business and consequently has become nobody's business.

It is a field that has largely fallen down, as it were, between the cracks. One official in our National Institute of General Medical Sciences recently made the comment, "We do not have a mandate within the National Institutes of Health whereby we have to work in the field of marine medicine."

Now, I think that that is a very truthful statement and a very unfortunate truth because I think that we need a mandate whereby an

agency of our Government by congressional legislation is going to establish a strong program, is going to conduct and sponsor research and going to do this in a very positive manner.

I would like to point out the interrelationships of some of these agencies and what takes place when we do not have a coordinated program.

We find that the National Cancer Institute is beginning to screen marine products: marine algae, invertebrates, and eventually fish, for biochemical substances having antitumor properties. Moreover, it is now known and positively documented that certain of these organisms possess biochemicals having antitumor activity.

The National Cancer Institute is dependent upon identification, a critical documentation of the organism, data on the origin of the organism, the environment from which this organism was taken and a taxonomic identification of the scientific name of the organism so that they can reproduce the field studies if necessary. The laboratory testing of these materials is very costly.

Now we find ourselves with a situation in which we have the Smithsonian Institution which is not geared in its thinking to the work of the National Cancer Institute.

The work of the Smithsonian Institution is to try to develop the overall field of systematics, biology, and so forth.

Nevertheless, we have medical agencies that are dependent upon systematic biology. I could include the National Institute of Mental Health, Neurological Diseases and Blindness, the National Heart Institute and so on, which have similar needs.

What I am trying to say is that we cannot vigorously pursue as a Nation the business of trying to determine the biomedical applications of these organisms unless we are backstopped by such agencies as the Smithsonian, the National Science Foundation, the Smithsonian Oceanographic Sorting Center, and so forth, because these are the groups, that must provide the basic data necessary to determine the name of a medically useful organism. This is a very vital requirement because we are now finding that many of these marine organisms produce valuable medicinal products.

We do not have a coordinated or integrated program. We need a National Institute of Marine Medicine and Pharmacology that can begin to assume by virtue of its congressional mandate the responsibilities for undertaking such a task.

At present we do not have such a national facility. As a result of this we do not have available to our Nation adequate field stations, or laboratories for use in biomedical oceanography. This brings up the next point that I would like to make if I may, Mr. Chairman.

I would like to direct your attention to this world map. Let us take the geographical distribution of marine organisms, with reference to their biochemical constituents and the toxic agents that exist within these marine organisms. We find the greatest concentration of these organisms in numbers and varieties of species within the Indo-Pacific area. The heart of this region is the Malay Archipelago. There are about 23,000 islands that make up the Malay Archipelago. Our closest American possession to this rich resource is certain parts of Micronesia, namely Guam. We also have access to the Trust Territory of the Pacific Islands, and this is the single resource area that frankly we have been most negligent about developing.

We have on the Island of Palau which is in the Western Caroline Islands, about 600-some odd miles southwest of Guam, a very magnificent island area. The Pacific Science Congresses have consistently noted the great scientific and economic importance of this area.

To date we have done very little for the Island of Palau. I just returned from Palau. I have had the opportunity of discussing this subject with a number of Micronesian Congressmen and they recognize that in an island community such as they have there are very few resources that they can develop but here is one of the wealthiest marine resources in the world and we are doing almost nothing to help them develop them.

Palau does not have the manpower. They do not have the technical assistance that is needed to develop their marine resources. Moreover, here is a very valuable marine resource that we as a nation can ill afford to waste.

Yet this is what we have done to date.

I want to point out to you that in the nearby Molucca Islands, on the Island of Ambon, the Russians attempted to develop what would have been one of the largest oceanographic facilities in the world. If I may have the other projector on, I would like to show you some of the photos of this facility.

I would also like to present to you two letters from Russian scientists as to what they are doing in the field of biomedical oceanography.

Here is also a statement that I have made on the Ambon station with a recommendation to the Government of Indonesia. I have recommended to them that they establish a President's Commission on Oceanography in order to develop this Ambon facility. I would like to present this to you.

Mr. Rogers. Thank you.

They will be made part of the record.

(The information follows:)

Akademia Nauk SSSR,
Cubirskoe Otdelenia,
Dal'nevostochnü Filial,
Institut Biologecheski Aktevnikh Veshchestv,
Vladivostok, July 31, 1968.

Bruce W. Halstead, M.D.,
Director, World Life Research Institute,
Colton, Calif.

Dear Dr. Halstead: I have just received your letter of July 17, in which you specified the time of your visit, October 1969. I am very grieved. Besides, it means the delay of my visit to you, I hope that you would have no objections against it, for one year. We are planning to make the trip together with the chemist Dr. V. Vaskovsky.

In these days I have reread with a great interest "Recommendation to the President's Commission on Marine Science, Engineering and Resources for a National Program in Marine Biomedicine". *We are very interested in problems of marine biomedicine and now take the necessary measures for development of such researches in our Institute.* Please, let us know what general materials in this field are published in the U.S.A. if possible send us the reprints. It is also interesting to know the further course of consideration and confirmation of your recommendations on the program of marine biomedicine.

I have already informed you that the second volume of your book had been safely received. Now I am taking the opportunity to thank you again. Please, confirm the receipt of my book on Eleutherococcus and three more books sent a little later. The Eleutherococcus extract will be sent to you early in August, 1968.

Cordially yours,

I. I. Brekhman, M.D.,
Professor.

APRIL 29, 1969.

DR. BRUCE W. HALSTEAD,
Director, World Life Research Institute,
Colton, Calif.

DEAR DR. HALSTEAD: Thank you very much for your letter of April 14, 1969. I am very grateful to you and the Drugs from the Sea Conference Sponsoring Committee for the cooperation in solving financial problems connected with our possible trip. However, my definite reply concerning my participation will be forthcoming after I had contacted the Academy of Sciences in Moscow.

I have already informed you that the title of my report is "Review of Pharmacological and Clinical Research of the Biologically Active Substances of Marine Origin in the Soviet Far East (1949–1969)". The report is ready and presently being translated into English.

I regret to say that information as to the exact date of my arrival in New York is still not available. As soon as it is, I will write you immediately.

I highly appreciate your active cooperation for our participation in the Conference.

Many thanks, and best regards.

Sincerely yours,

I. I. BREKHMAN, M.D.,
Professor.

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22 APRIL 1969.

MEMORANDUM

From: BRUCE W. HALSTEAD, M.D., *Director, World Life Research Institute, Colton, Calif.*

Re Ambon Oceanographic Station.

The Ambon Oceanographic facility was originally developed as a result of a loan or a grant received from the USSR to Indonesia. The station is presently about 80 percent completed. The station is under the administrative jurisdiction of the Ministry of Education of the Indonesian Government and has lapsed into a period of disuse due to a lack of financial resources. The station was originally designed by Soviet technicians working in collaboration with the Indonesian Government and was to have been developed on a mammoth scale. If completed, it would have completely dwarfed any other existing oceanographic facility. The Ambon station is physically located in the midst of the richest marine floral and faunal belt of the world. This facility offers tremendous potential for the total development of oceanographic resources of the more than 13,000 islands of Indonesia.

It is recommended that this facility in the future be removed out of the Ministry of Education of the Government of Indonesia and be placed under the jurisdiction of a special Indonesian Presidential Oceanographic Commission who would operate this station for the total benefit of all of their various ministries. The station in the future should be closely allied with a large commercial corporation operating under a systems management type of a program. Although the station should be developed along education and research lines of endeavor, it should seek to meet the total nation's needs in terms of offshore petroleum mining, fisheries, aquaculture, marine pharmaceuticals, pollution, defense, navigational, natural gas, etc. This station should serve as a hub for the total oceanographic research programs of all Indonesian agencies. Moreover, it is recommended that the station serve as a liaison operation working in close cooperation with the United Nations program on the International Decade for the Exploration of the Sea.

The administration of this station should be autonomous and operate directly under the President rather than through any Ministry. This is of the utmost importance if this station is to be successfully developed for the overall good of the country. It is believed that there are sufficient commercial applications and incomes that could be developed from various and sundry sources to provide for the total operational costs of this project. It is recommended that some sort of a lease management arrangement be develped with a private commercial corporation working in very close liaison with the Presidential Oceanographic Commission.

Dr. Halstead. The oceanographic station that the Soviets started to establish at Ambon was on the basis of a loan to the Government of Indonesia. This project came to an end, at the time at the coup when President Sukarno went out and General Suharto took over.

The station is on the edge of a deep water bay, a very beautiful bay, and is located in an area having rich biological oceanographic resources.

The next slide shows the facility which is now about 80 percent complete—I would estimate. Several million dollars was spent there. I have heard estimates of $4 to $5 million.

This is the main administration building and with it some of the classrooms.

You will see that this is a part of the engineering complex, and you will notice that the entire facility today is overgrown with jungle growth.

This is part of the housing area. These are very excellent houses. I have been through all of the facilities, and there are some magnificent structures. Here are some of the engineering facilities that the Soviets had developed. This is all Russian machinery. The legends are in English. This material is sitting here today and is fully operational. It is not all rusted out. It has been well preserved.

This is one of the classrooms.

This was the main library. This facility was attached to the University of Ambon. This last picture shows you the generator plant.

I point this facility out to you because the Russians had planned a very extensive oceanographic program. In my discussions with Soviet scientists in the area of oceanography and pharmacology I have asked them repeatedly as to whether or not they have plans to get into the area of marine pharmacology, and develop these marine biochemical resources.

They have emphatically stated that they are already beginning to work in biomedical oceanography. In fact, they are presenting a review of ten years of pharmacological research at the next Marine Technology Society meeting which will be held in August at the University of Rhode Island on the Food-Drugs from the Sea conference.

The significance of this subject is very clearly understood by Soviet scientists, and they have been working and are going to continue to work very actively in this field.

I have a section here, looking at page 5, of my written presentation on The Need of Regional Marine Health Laboratories. I think this is self-explanatory.

There is a need for field laboratories, and I would like to direct your attention specifically to the center of page 6 with reference to Palau. I would like to urge that we give serious attention to the establishment of a marine biomedical oceanographic laboratory at Palau.

The place is uniquely situated within a short distance from Ambon where the Russians were building this tremendous facility. It is my hope that we can also give some attention to the possibility of working out a cooperative effort with the Indonesian Government in the further development of this station.

I have discussed this matter with Ambassador Adam Malik of the Indonesian Government and he tells me that his Government would welcome a cooperative program with the United States.

On the need for a national research vessel facility: at the present time we do not have a single research vessel for use in biomedical oceanography. Such a vessel has specific requirements in terms of refrigeration facilities and collecting facilities. We have found from past experience that biomedical activities do not operate at optimum efficiency when mixed with other oceanographic operations.

I have a list here of research projects which I don't believe I need to go over with you at this time.

I would like to turn to page 9 to discuss briefly the subject of publication of results. We have a very distressing situation that exists within our Government where surprisingly little attention is being given to the publication of the results of scientific research.

We seem to have an abundance of money to sponsor the research but when the research is completed we don't seem to have sufficient funds to publish the results, and I am referring specifically to large monographs.

There is a particular value in doing major monographic studies in which you synthesize a lot of abstract and isolated bits of information and try to begin to put it together as a whole.

I know of many investigators in the field of biology, medicine, and other areas that avoid doing a major study for the simple reason that it is too difficult to get the results published. I can cite my own sad experience. These volumes were completed in 1957 even though we had over a million dollars invested in the background research we then fought for the next 5 years trying to get sufficient funds to publish the results. It was by virtue not of interest in terms of agencies as it was of the interest of two or three people that finally made it possible to publish these results.

Now, I think, gentlemen, that this is a very sad commentary on our scientific system where we have people that think that this research is worthy to be done but apparently not worthy enough to be published. Moreover, in biological oceanography many of these organisms if they are going to mean anything to the individual that is going to see this material need to be published in color. There is a tremendous difference between a black and white photo and an organism that is brilliantly colored. When you are in the field you frequently identify an organism because of its coloration not because of its black and white appearance which really does not exist in nature.

I mention this because I think that this is a critical area that needs very careful attention in the future.

I would like to touch finally on economic returns and the problem of industry-government liaison. I work with a good many large industrial organizations, not only within our own Nation but also with other countries, and I find that there is need for better Government-industrial relations. This is going to be particularly true if we move ahead in the field of biomedical oceanography.

First of all, when we talk about trying to develop our biochemical marine resources we must provide an enormously expensive and time-consuming groundwork that has to be laid before a company can begin to commercialize these biochemical products. This is a serious problem because, unless this groundwork is laid in a systematic manner, neither industry nor Government is able to develop these resources.

This now points up another problem. Let us assume that the U.S. Government has laid the groundwork either through grant-in-aid or through a systems management approach by contract.

The groundwork has been laid. Let us say it has been done through the National Science Foundation through a university or nonprofit research institute and the basic data are available. You have finally located a substance which has valuable commercial properties, and it is released to a company for commercial development.

The company begins to back away from the product because of Government contact, because of Government contamination as it were. The question comes up, "Who is going to have the patent rights? How can we reclaim our investment that we are about to make which may mean x millions of dollars? How do we justify this to our stockholders?"

So we have to try and develop some sort of a system where the Government is beginning to work for the benefit of industry here, and I think that industry in turn will be working for the benefit of Government. As I talk with many of these industrial groups I find a very definite gap that is very difficult to bridge.

I am presently involved in this situation. We are studying a toxic microorganism that may have pharmaceutical potential. The Federal Water Pollution Control Administration has asked us to take a look at this material to evaluate it as to its commercial potential. We have a grant.

The big problem we find now is trying to get a company that is willing to work with us because we have received support from the Federal Government.

This is a delicate area of Government-industrial liaison that requires immediate attention. At the present time we are suffering from a deficiency of certain types of drugs within our Department of Defense because industry is not in a position to develop them when they have either a limited use or they have the problem of Government control in some way.

I think, Mr. Chairman, that these are my remarks.

(Dr. Halstead's prepared statement follows:)

STATEMENT OF BRUCE W. HALSTEAD, M.D., DIRECTOR, INTERNATIONAL BIOTOXICOLOGICAL CENTER, WORLD LIFE RESEARCH INSTITUTE, COLTON, CALIF.

Background data: This presentation is based on a report prepared by the Subcommittee on Marine Biomedicine, Marine Technology Society, which was submitted to the President's Commission on Marine Science, Engineering, and Resources, dated 19 December 1967. In this report the Subcommittee recommended to the President's Commission that the U.S. Congress establish a National Institute of Marine Medicine and Pharmacology. This presentation is concerned with the subject of biomedical oceanography and the need for establishing a National Institute of Marine Medicine and Pharmacology as recommended in the Commission's report, Our Nation and the Sea. Members of the Marine Technology Subcommittee were as follows:

Bruce W. Halstead, M.D., Chairman, International Biotoxicological Center, World Life Research Institute, Colton, California 92324.

Earl Herron, Vice Chairman, Hercon, Inc., Scotch Plains, New Jersey.

Paul Burkholder, Lamont Geological Observatory, Columbia University, Palisades, New York.

Ara Der Marderosian, Philadelphia College of Pharmacy and Science, 43rd and Kingsessing & Woodland Aves., Philadelphia, Pennsylvania.

Norman R. Farnsworth, Department of Pharmacognosy, School of Pharmacy University of Pittsburgh, Pittsburgh, Pennsylvania 15213.

Hugo D. Freudenthal, Long Island University, East Meadow, New York.
George F. Greene, Jr., Abbott Laboratories, Hicksville, New York.
Gilbert V. Levin, Biospherics Research Institute, Washington, D.C.
Ross F. Nigrelli, Osborn Laboratories of Marine Sciences, New York Aquarium, Brooklyn, New York.
George D. Ruggieri, S.J., Osborn Laboratories of Marine Sciences, New York Aquarium, Brooklyn, New York.
Findlay Russell, Laboratory of Neurophysiology, Los Angeles County Hospital, University of Southern California, Los Angeles, California.
Paul Saunders, Marine Sciences Program, University of Southern California, Los Angeles, California.
John Sieburth, Graduate School of Oceanography, University of Rhode Island, Kingston, Rhode Island.
Heber W. Youngken, Jr., College of Pharmacy, University of Rhode Island, Kingston, Rhode Island.

DEFINITION OF "MARINE BIOMEDICINE"

The term "marine biomedicine" as used in this presentation is concerned with such disciplinary areas as marine biochemistry, pharmacology, pharmacognosy, toxicology, nutrition, microbiology, physiology, epidemiology, taxonomy, ecology, pathology, ethnobiology, medicine, marine biomedical literature documentation and retrieval, bionics, technology and instrumentation that have a bearing on national and international marine-derived solutions to health problems. Although the aforementioned areas appear to be of greatest concern, marine biomedicine is not necessarily limited to these subjects. In brief, marine biomedicine is concerned with those aspects of the total marine biotope that have both a direct and indirect bearing on man's health and welfare.

INTERNATIONAL SCOPE OF MARINE BIOMEDICINE

International cooperation in the scientific study and use of the sea and its biomedical resources is imperative for the following reasons:

The world ocean covers 71 percent of the earth's surface. Most countries have sea coasts and make some use of the sea, although national jurisdiction extends over only a small fraction of the ocean's area; the remainder is common property. The waters of the world ocean and their contents intermingle without serious restraint. Many oceanic processes are of large scale and are driven by forces of planetary dimension. The organisms inhabiting the sea are influenced by these processes and forces, and their distribution, abundance and behavior are often influenced by events occurring far beyond the territorial limits recognized by man.

(FAO Fisheries Rept. No. 41, Suppl. 3, October, 1967.)

In this regard, it is recommended that a national marine biomedical program should be global in scope and integrated with the international cooperative efforts of such organizations as the Food and Agriculture Organization of the United Nations, World Health Organization, Sicentific Committee on Oceanic Research, International Biological Program, International Council for the Exploration of the Sea, and other international agencies. A more detailed report of the recommendations of these organizations appears in a booklet entitled "International Ocean Affairs; A Special Report of the Joint ACMRR/SCOR/WHO (AC) working group on the Implementation of the United Nations Resolution on the Resources of the Sea" published in FAO Fisheries Reports No. 41, Suppl. 3, FRM/R41 Suppl. 3(En), Rome, October 1967.

In order to fulfill the need for protein for the world's burgeoning populations, many countries including the USA will have to augment drastically both agricultural and marine resources. If it is decided to increase the harvesting and to start the herding of marine animals, then it is essential to study not only the health safety of potential food species but also the organisms in their food chain which are potential contributors to biotoxicity and pathogenicity in man.

RECOMMENDATION FOR A SYSTEMS MANAGEMENT APPROACH

It is recommended that a systems management approach be used in order to avoid useless duplication of effort and funding. The systems approach has been used with much success in the development of the space program, and it is believed that it would contribute materially to the successful operation of the pro-

jected marine biomedical program. It is believed that present grant-in-aid methods are inadequate to meet our future national oceanographic requirements.

Industrial management techniques, engineering "know-how," economic data evaluation methods, etc., can be of value in developing procedures for the utilization of marine biomedical resources. There is need for further exploration of the manner in which industry, government, and academic institutions can work together in areas of mutual interest.

THE NEED FOR A NATIONAL MARINE BIOMEDICAL COORDINATING COMMITTEE

If our national goals are to be achieved, leadership from our national Government must be forthcoming. It is most urgent that marine biomedicine be recognized by our leaders in Government as a specific disciplinary entity, that our existing deficiencies in this field be clearly understood and that adequate governmental organizations be provided to deal properly with the subject. It is apparent that some facets of marine biomedicine merit greater attention and fiscal priority than others.

Since the subject matter is multifaceted and international in scope and comes within the purpose of several Federal agencies, a coordinated approach is highly desirable. It is therefore recommended that a standing Marine Biomedical Coordinating Committee (MBCC) be established and that this committee operate under the National Council for Marine Resources and Engineering Development (or its successor—if the present Council should be disbanded).

It is further suggested that the membership of this committee include representatives of the following groups: President's Scientific Advisory Committee, National Council for Marine Resources and Engineering Development (or its successor), Department of Health, Education, and Welfare (Public Health Service, National Institutes of Health), Department of Interior (Bureau of Commercial Fisheries and Federal Water Pollution Control Administration), National Science Foundation, Environmental Science Service Administration, Department of Commerce, Atomic Energy Commission, Department of State National Aeronautics and Space Administration, Department of Defense (ONR), and a select number of consultant specialists from universities, research institutes, industry, and biological and medical professional societies.

The purpose of the MBCC would be to establish national goals and to coordinate programs of interagency, national, and international importance in the area of marine biomedicine. The MBCC could serve a useful function as a scientific advisory body to the U.S. Congress. The activities of MBCC should be assisted by means of a full-time executive secretary and a clerical staff.

ESTABLISHMENT OF NATIONAL INSTITUTE OF MARINE MEDICINE AND PHARMACOLOGY

The Congress of the United States should be encouraged to establish a National Institute of Marine Medicine and Pharmacology (NIMMP) within the Department of Health, Education, and Welfare. The institute should be established for the purpose of conducting and supporting marine research with a view to advancing scientific knowledge in marine biochemistry, pharmacology, pharmacognosy, toxicology, nutrition, microbiology, epidemiology, physiology, taxonomy, ecology, pathology, ethnobiology, bionics and technology as it may relate to the causes, diagnosis, prevention, treatment, and control of physical and mental diseases and other impairments of man. The NIMMP should have an advisory council to advise, consult with, and make recommendation to the Surgeon General on matters relating to marine medicine and pharmacology. The institute should be authorized to provide training and instruction, establish traineeships and fellowships, and provide research grants to public or other nonprofit institutions. An international exchange of graduate and post-doctoral students should be encouraged. Numerous land-locked schools and universities are desirous of obtaining access to marine field facilities. Every attempt should be made to provide access to adequate educational and research facilities for these inland institutions. Educational programs should also be provided for the training of skilled technicians. There is urgent need for more adequate support of educational programs in marine biomedicine.

THE NEED OF REGIONAL MARINE HEALTH LABORATORIES

The Public Health Service presently operates three marine health laboratories. These are situated in Washington, Rhode Island, and Alabama. These laboratories are concerned with the general areas of the health aspects of water pollu-

tion control, nutritional values and health hazards of sea resources, marine biotoxicology, infectious agents, hypersensitivity reactions to marine products, physiological effects of the marine environment on man, pharmaceuticals and drugs from the sea, and other general marine health problems. The present support level of these laboratories is inadequate. These laboratories should be upgraded, adequately funded, and their operations expanded. These regional laboratories should be adequately equipped for advanced sophisticated analytical research.

It is further recommened that additional sites be considered for the establishment of regional marine health laboratories in Alaska, Hawaii, Rhode Island, California, Florida, Texas, or the Virgin Islands. One or more of these laboratories should serve as technical documentation centers.

THE NEED OF REGIONAL MARINE BIO-MEDICAL FIELD LABORATORIES

There is urgent need for international field research facilities for investigators needing to work in specific geographical (continental or insular, temperate, subtropical, tropical, or polar) oceanic regions. Field research units would in most instances be minimal field facilities but with maximum accessibility to field resources. These laboratories would be used primarily for the procurement of living specimen materials, ecological, physiological, and other types of activities that could not be conducted to a greater advantage elsewhere. Each laboratory would be of a standard format and would have collecting gear, diving equipment, and small vessels (approx. 45 ft.) suitable for making local field studies.

The following field sites are recommended on the basis of their strategic environmental and geographical locations. These field units could be operated either under contract with a private nonprofit organization or directly by a governmental agency. Recommended sites are as follows:

Trust Territory (Palau,* Jaluit)
Line Islands (Palmyra)
Samoa
New Caledonia*
Society Islands*
Great Barrier Reef*
Korea*
Japan*
Ethiopia
India*
Virgin Islands (St. Johns*)
Cozumel
Honduras
Canal Zone*
Indonesia (Ambon*)
Thailand*
Seychelles
East Africa*
Aegean-Adriatic areas
British Isles*
West Africa
Azores
Brazil*
Galapagos Islands*
Gulf of California*
Pt. Barrow, Alaska*
Palmer Station, Antarctica*

*Indicates that there is an existing facility, but most of these present facilities are in dire need of more adequate support.

Most of these localities are readily accessible by air transportation.

Particular attention is directed to the fact that the greatest assemblage of marine organisms possessing biodynamic substances is found within the Malay Archipelago (Sumatra, Java, Lesser Sunda, Moluccas, Timor, New Guinea, Borneo, Celebes, and the Philippines). It is noted with deep regret that the United States has not used to advantage one of the richest biotic provinces in the world which is available to our country through Palau in the Trust Territory. Palau lies on the eastern border of the Malayan Archipelago and is about 400 to 600 miles northeast of Ambon in the Moluccas where the Soviets had almost completed building an enormous oceanographic facility for the Indonesian Government. It is highly recommended that a biomedical research laboratory be established in Palau at the earliest possible moment.

THE NEED FOR A NATIONAL RESEARCH VESSEL FACILITY

A single large research ship (5,000 ton class) should be made available and equipped as a national facility for marine biomedical investigations. In addition, it is recommended that smaller vessels (approx. 45 ft. in length) be assigned to regional field facilities for local operations. These vessels should be specially designed for biomedical ocean work and adequately equipped for survey, collecting, and diving operations. Special attention needs to be directed to the problem of refrigeration and low temperature requirements suitable for the preservation

of venoms, enzymes, etc. Many scientists are desirous of investigating biomedical problems but are unable to obtain the necessary logistics support. Laboratory and research vessel facilities are urgently needed for biomedical studies.

INSTRUMENTATION NEEDS

It is imperative that the effectiveness of instrumentation to be used at sea be increased, since this is the major avenue by which the effectiveness of the research investigator can be improved. The design of instruments intended for use in the marine environment is at present left to the ingenuity and usually meager facilities of the individual who needs them. Although miracles are achieved by this route, it subverts time of biologically trained men, and their lack of training in engineering and some of the physical sciences is often evident in the result.

It is therefore recommended that funding for research and development of instrumentation, collecting devices, diving research vehicles, and data handling and processing equipment be specifically directed towards that segment of our economy which can best satisfy this need—industry. In order to guide the selection of projects to be funded, it is suggested that review panels be set up within the framework of the Marine Biomedical Coordinating Committee for this purpose. These review panels would have the specific task of making recommendations of areas of technology and instrumentation which need improvement. The means for effecting this improvement would be left to industry and engineers, working in close collaboration with scientists.

RECOMMENDED AREAS OF MARINE BIOMEDICAL RESEARCH

The following are some suggested areas of marine biomedical research which are urgently in need of attention. Undoubtedly there are other priority areas which have been overlooked, but these suggestions provide a rough guideline to the scope of marine biomedical research that is needed.

Taxonomy and ecology of medically important marine organisms, particularly dangerous marine animals of all types. Studies should include photographic documentation of their habits, habitat, identification, etc.

Screening of marine organisms for biological activity.

Investigation of the food web of marine organisms.

Study of triggering mechanisms in the production of toxicity cycles in marine organisms.

Uses of marine organisms as biomedical research tools.

The investigation of industrial waste product contaminants involved in the food web of marine organisms.

The use of marine organisms as sources of new drugs.

Investigation of marine biochemical substances as models for the development of new synthetic chemicals.

Evaluation of health safety standards for new marine-derived foods.

Development of laboratory culture techniques of marine organisms that are likely to serve as sources of either new foods or useful biochemical agents.

Clinical aspects, diagnoses, treatment and prevention of marine biotoxications and other marine-induced diseases.

Study of disease processes in marine organisms.

Epidemiology of marine biotoxications.

Mass aquaculture techniques for the production of food and useful biochemical agents.

Study of the effects of aquaculture as it relates to environmental disease production and control mechanisms.

Origin of toxic and other biologically active substances in marine organisms.

Development of surveillance systems of commercial marine food and drug products.

The study of the use of marine organisms by primitive native groups.

Chemical and pharmacological properties of biologically active marine substances.

Marine bionics.

Chemotaxonomy of marine organisms.

Investigation of food detection and sensory mechanisms in marine animals.

A national file for the storage and retrieval of marine health information.

Investigation of the nutritional potential of plankton.

Investigation of marine pathogenic microorganisms.

The study of hypersensitivity reactions to marine organisms.
Physiological effects of the marine environment on man.
The relationship of marine organisms to the Man-in-the-Sea Program.
Health aspects of ocean pollution.
Anatomy of the venom organs of marine organisms.
Physiological hazards relating to diving, such as: effects of pressure, inert gases, increased oxygen tensions, etc.

PUBLICATION OF RESULTS

There is a dearth of useful marine information that is available to both the scientific and lay public. Greater attention needs to be directed to the quality, publication and public dissemination of scientific findings. Adequate funding should be provided for the publishing of investigative results in technical journals and well illustrated manuals, monographs, and books. Documentary educational films are needed for civilian and the Military. The production of these films should be encouraged and funded.

ECONOMIC RETURNS

Benefits to be derived from biomedical research are both immediate and long-term. Laboratory studies have shown that there is a vast spectrum of marine bioactive substances having antibiotic, antiviral, and fungicidal properties. There is evidence that many of these substances will have immediate commercial potential. There is also a great variety of systematic drugs affecting the nervous system, cardiovascular, urinary, gastrointestinal, and various other organ systems. Some of the greatest medical problems facing mankind today are concerned with the chronic degenerative diseases, cancer, heart disease, neurological disorders, mental health, arthritis, etc. Marine organisms provide an untapped wealth of plants and animals that either store or produce a fantastic array of complex chemical substances, many of which offer exciting possibilities as new therapeutic agents.

World fisheries are beginning to expand rapidly into tropical seas, and greater attention is being directed to shallow-water shore fisheries operations. There is urgent need for a more effective utilization of the so-called "trash species" in warm water areas. The utilization of a broader spectrum of tropical marine organisms as food products has brought about an unprecedented confrontation with an enormous array of poisonous marine organisms. Toxic marine organisms range throughout the phylogenetic series of plants and animals. The toxicity of some of these poisons are about 10,000 times that of sodium cyanide or about 3,000 times that of our better war gases. With the necessity of developing protein concentrates from an ever increasing variety of marine organisms, it is urgent and necessary that the edibility of all marine organisms be evaluated, particularly if they are likely to be used in the production of protein concentrates.

The prospects of using protein resources from the sea for human and animal consumption are becoming increasingly more difficult as toxic industrial wastes are being discharged into the marine environment. The devastating outbreaks of Minamata disease in Japan document the serious threat that industrial wastes contribute to the food economy of the sea. The Minamata situation points up the fact that in the future we must be prepared to cope with toxic products from both natural and industrial sources which become incorporated in the complex food web of the sea. In the preparation of FPC we may also encounter a concentration effect of trace elements and other industrial chemical compounds that could eventually result in serious disease problems. This is an area of research that is going to require carefully controlled long-term chronic toxicity studies. At the moment there is no evidence that any serious consideration is being given this subject.

Important economic by-products will also result from a national effort in biomedical oceanography in the area of education. New job opportunities will be developed and new educational programs will be required.

The untapped biochemical wealth of the sea offers some of our richest resources with the promise of immediate returns as nutrients and useful therapeutic agents which are likely to prove to be highly effective against some of mankind's most devastating ills. Marine biotoxins play a dual role of being able to preserve life as well as to destroy it. We must learn how to utilize these substances for the benefit of all mankind.

NEED FOR INDUSTRIAL-GOVERNMENT LIAISON

Provision should be made to establish an effective liaison between government and industry. If the biochemical wealth of the oceans is to be successfully utilized, there must be brought about a much closer working relationship between government and industry. Most pharmaceutical companies are not in a position to undertake the expensive logistics, procurement, and documentation program that is required before a marine organism can be assayed for its pharmacological properties. These initial studies will of necessity have to be funded by government. A great deal of fundamental research will be required in order to develop commercially feasible aquaculture techniques for the rearing of marine organisms having marine pharmaceutical potenial. It is noteworthy that at least one commerical company (Aquarium Systems, Inc., Wickliffe, Ohio) is presently exploring the rearing of marine pharmaceutical organisms. It is important that some sort of a cooperative program be established with private enterprise so that compounds having commercial potential can be profitably marketed and thereby enhance our economy. This is a very critical area that must be carefully evaluated if these biochemical products are to be of economic value to our nation.

Mr. Rogers. Dr. Halstead, your remarks have been excellent and most impressive. I am sure that the committee will benefit greatly from your testimony.

Mr. Karth.

Mr. Karth. Thank you, Mr. Chairman.

I want to join the chairman in suggesting strongly that this has been a very exciting presentation you have given to us, Doctor. I am not so sure, however, that you are in front of the right committee.

Dr. Halstead. That may be.

Mr. Karth. Since you recommend that the National Institute of Marine Medicine and Pharmacology be established in HEW you should also make this presentation before the Education and Labor Committee.

Mr. Rogers. Will the gentleman yield?

Mr. Karth. I will yield.

Mr. Rogers. I might say that I am ranking member on the Health Subcommittee which has jurisdiction. So maybe we have overlapped a little here and I will make sure that a similar presentation with the Doctor is made to the Health Committee which will have jurisdiction.

Mr. Karth. That is a subcommittee of this committee.

Mr. Rogers. Insterstate and Foreign Commerce.

Mr. Karth. Since it deals with the Department of HEW, I don't know which subcommittee would be the proper one for you to also make this presentation to but I think it is of sufficient interest that you really ought to explore it with the chairman, Doctor.

I really agree with you that something ought to be done and some of us around here have been talking about this whole ecological question for a number of years now.

Since the Government has finally become interested I think by virtue of some of the things that you have called to our attention and many that you probably know about and haven't had time to call to our attention, I think it is encouraging that at least we are moving in the right direction or making some noises that we are going to move in the right direction.

Might I ask this question, Doctor.

You do propose that an Institute of Marine Medicine and Pharmacology be established in HEW. Since it is dealing primarily with marine medicine I was wondering whether or not, if the Congress is

able to reorganize and restructure so that a NOAA is established would it be better perhaps to consider that this be a separate office of NOAA as opposed to being a separate office of HEW?

Dr. HALSTEAD. Mr. Chairman and Mr. Karth, may I comment on this that unfortunately in Government and education and science we have a way of fractionating everything; this is physics; this is chemistry; this is astronomy and never are they going to meet.

Unfortunately in nature they don't occur this way. While I have been directing my remarks to the establishment of a National Institute of Marine Medicine and Pharmacology if you were to appropriate money for the establishment of such an institution they would still be directly dependent upon a solid groundwork that hopefully is being laid in, for example, the Smithsonian Institution, the National Science Foundation, or the Department of the Interior.

You see, it depends on many of these things.

Mr. KARTH. I agree but one of the reasons, Doctor, why we are thinking favorably about setting up a NOAA is to bring the many splintered parts of marine sciences and marine resources together under one head to give it some direction.

I am not so sure but that if we begin at the same time to fragment certain parts of it, for example the recommendation you made, by putting these things in existing agencies that really do not or will not have the interest that a NOAA might have in it, that again we would be fractionating or fragmentizing what we seek to bring together under one head and give to it some impetus and direction and I might say a reasonably decent level of funding.

I just wanted to explore that with you. I don't suppose you have any great feeling as to where it should be so long as it performs the purpose intended.

Dr. HALSTEAD. I think your suggestion is certainly a very valid one that it has to go into an integrated segment of Government.

Mr. KARTH. Just one final comment, Mr. Chairman. I know it is getting late.

In many instances in our grant-in-aid programs we spend fantastic amounts of money if we really add up the programs that we fund. I agree with you that in many instances these moneys are probably not really spent in the best possible way and the systems management approach is much better.

On the other hand, of course, we need some grant-in-aid programs because the grant-in-aid programs are primarily basic research in character where the systems management approach is more or less applied research and development.

I don't mean to say that it can't be both basic research and applied research and development but the fact of the matter is that in many instances they don't go hand in hand because of the nature of the beast of basic research.

But I do agree with you that greater efforts I think ought to be made to consolidate within one agency of the Government the basic research that we do in the Nation because again there is a great deal of duplication in our basic research effort, the Department of Defense, NASA, the National Institute of Health, the National Science Foundation and in many instances I am led to believe that one hand really don't know what the other is doing.

Resources in this area are limited at best.

I do want to thank you for your contribution.

Dr. HALSTEAD. Thank you.

Mr. PELLY. I would like to pursue this further but I believe we have one more witness. I simply want to add my word of thanks. I think everything you have said is very pertinent to the matter which this committee now has under consideration and you have made a very great contribution.

Dr. HALSTEAD. Thank you, sir.

Mr. ROGERS. Thank you so much, Dr. Halstead.

We are pleased to have before the committee, Dr. George Sullivan, who was a distinguished member of the President's Commission and helped to write the report which this committee is conducting hearings upon now. Let Dr. Sullivan's biography appear at this point in the record.

(The biography of Dr. Sullivan follows:)

BIOGRAPHY OF GEORGE H. SULLIVAN, M.D.

Consulting Scientist, General Electric Co., Reentry and Environmental Systems Division.

Dr. Sullivan has 20 years of diversified experience in medicine, biology and systems engineering in ocean systems and aerospace systems. He graduated from the U.S. Naval Academy in 1948 with a Bachelor of Science degree and received his Doctor of Medicine degree from Georgetown University.

He was a member of the President's Commission on Marine Science, Engineering and Resources which had the responsibility to develop a comprehensive Marine Science for the nation.

Mr. ROGERS. Dr. Sullivan, we will be pleased to hear your remarks.

STATEMENT OF GEORGE H. SULLIVAN, M.D., CONSULTING SCIENTIST, GENERAL ELECTRIC REENTRY AND ENVIRONMENTAL SYSTEMS DIVISION; MEMBER, COMMISSION ON MARINE SCIENCE, ENGINEERING AND RESOURCES

Dr. SULLIVAN. Thank you, Mr. Chairman.

Mr. Chairman, my remarks will be very brief so that I won't hold the subcommittee except that I want to add to what Dr. Halstead was covering a little discussion of what I call marine medicine or biomedicine and even more aptly defined as diving medicine.

What I am talking about is really basic knowledge and is the understanding of the movement and transport of gases into and out of the lungs, across the membrane of the lungs, and into and out of the body tissues.

Most here have heard of the term bends and relate this to the small bubbles that form in the tissue and become painful as the diver returns to the surface.

However, few of us relate this process to the terms of the absorption of oxygen or nitrogen or carbon dioxide or helium, or yes, even smog through the lungs, not only absorbed through the lungs but into the bloodstream and then into the muscles and brain.

A study of diving medicine, of course, is the study of the transport of these gases into the body.

This field has not progressed at what I believe is a satisfactory rate, primarily because it has been scattered as the other marine activities have been scattered, and secondly there isn't enough of it being done to form a critical mass.

With regard to Congressman Karth's references to the National Institutes of Health, there we study the lung in the Heart Institute and in the Cancer Institute, and we study emphysema in the Arthritic Institute. In all of these they may look at the transportation of gases across the lung but are trying to build on a basic set of knowledge that doesn't exist.

They are trying to build on what I call diving medicine. Naturally these institutes have their own resource programs which are formed specifically for their own purposes, but the diving medicine program has not developed. As of today there are only two universities in the United States which have diving medicine programs: Duke University, which went on line almost a year ago, and the University of Pennsylvania, which perhaps this October will come on line.

I have discussed the biomedical program at length with Dr. Robert Frosch, the Assistant Secretary for R. & D., and he has highlighted two problem areas in the Navy program: One, they do not have a source of trained personnel in diving medicine, and two, they do not have adequate facilities.

A full discussion of the inadequacies of our facilities and our educational capabilities relating to diving medicine is contained in the report of the Marine Science Council's Committee on Marine Research, Education and Facilities.

This committee was chaired by Dr. John Craven, whom I believe is well known to this committee.

This leads me to the conclusion that in order to foster marine biomedicine and to evaluate the biological active substance in the sea that we need some central focus. Initially, I would think that the focus would belong in the National Institutes of Health.

However, I believe that this central focus must be supported by NOAA at least for supporting the facilities in a similar manner that we support oceanographic ships. It is not difficult to select areas in the country where such facilities might well belong. I have Miami written here. I don't have Palm Beach.

Mr. Rogers. That is too bad but that is pretty close.

Dr. Sullivan. Also areas like Galveston where the University of Texas Medical School is located, the University of California at San Diego where Scripps has a program outlined but is totally lacking funds because it doesn't have a champion to support this program, and, similarly, in the Northwest in Seattle is another area where the medical schools and the ocean program should be tied together.

Mr. Chairman, those are just my brief remarks.

Mr. Rogers. Thank you.

That is most helpful to us.

Mr. Karth?

Mr. Karth. I have no questions.

Mr. Rogers. Mr. Pelly?

Mr. Pelly. I have no questions.

Mr. Rogers. Thank you very much, Dr. Sullivan.

The committee will stand adjourned until the call of the Chair.

(The following was received for inclusion in the printed record:)

STATEMENT OF WILLIAM F. ROYCE, ASSOCIATE DEAN, UNIVERSITY OF WASHINGTON

The creation of the National Oceanic and Atmospheric Agency (NOAA), a superagency for the oceanic affairs of the U.S. Government, has been proposed by the Commission on Marine Science Engineering and Resources. The agency would administer the nation's civil marine and atmospheric programs. It would include the U.S. Coast Guard, the Environmental Science Services Administration, which already includes the Weather Bureau and the Coast and Geodetic Survey, the Bureau of Commercial Fisheries and the marine and anadromous fisheries functions of the Bureau of Sport Fisheries and Wildlife, the National Sea-Grant Program, the U.S. Lake Survey, and the National Oceanographic Data Center.

Significantly, the new agency would not include a number of marine and atmospheric functions that are integral to other agencies such as the Marine Defense Program of the Navy, the basic research of the National Science Foundation, the specialized programs of NASA, the Atomic Energy Commission, and the Corps of Engineers which have rather little relation to marine resources, and the Water Management Programs of the Department of Interior. This omission emphasizes the orientation of NOAA toward use of the sea and its resources.

Also recommended for the new agency would be new responsibility for (1) institutional support of University National Laboratories and Coastal Zone Laboratories, (2) development of fundamental marine technology, (3) formulation and implementation of national projects and grants to states for coastal zone management, and (4) development and coordination of weather modification activities.

All of the Commission's recommendations represent an effort to strengthen greatly the nations capability in the use of the sea and its resources. They would strengthen both science and basic technology that are important to all users of the seas. They would bring together in a single agency or coordinate better the fishery management functions, the international enforcement of fishery regulations, the forecasting of oceanic conditions that can be useful to fishermen, the development of better charts and aids to navigatnon, and the standards for vessel inspection and licensing. Further, they would strengthen the ties between resource agencies and the universities and the coordination between state and federal fisheries.

The Commission that prepared this report was appointed by President Johnson in January, 1967. The members represented diverse institutions and areas of the country, universities, a state agency, federal departments, and U.S. business. Their activities and interests were a substantial shift away from the oceanographic emphasis long provided by Woods Hole Oceanographic Institution and the Scripps Institution of Oceanography, which were not directly represented. The Commission had four congressional advisors: Senators Cotton and Magnuson, Representatives Lennon and Mosher.

The fisheries people in the Pacific Northwest will have an interest primarily with respect to the recommendations from the Panel on Marine Resources, which included Professor Crutchfield of the University of Washington's Department of Economics and David A. Adams, Commissioner of Fisheries from North Carolina. The fisheries people will have special interests also in recommendations of the International Panel, which was chaired by Professor Auerbach from the University of Minnesota Law School and included as members Mr. Blaustein, a director of the Standard Oil Company, and Mr. Jaworski, an attorney.

With respect to the development of the living resources of the oceans, the Commission has produced a number of specific recommendations to guide the new agency. The emphasis and the arrangement of these recommendations stem largely from Professor Crutchfield's economic approach to fishery problems. The Commission recommends that a major objective of fishery management should be to produce the largest net economic return consistent with the biological capabilities of the stocks. It views this course as vital to the expansion of the fishing industry, which is faced with rapidly increasing costs and slowly increasing prices for its fish. The Commission recommends the reduction of fishing effort on some heavily exploited stocks, but does not, however, suggest how this should be done. It does recognize the difficulty that the United States would have if it attempted to limit effort in international fisheries and the fact that fishermen in

some localities will prefer to fish with small, inefficient vessels. The Commission recognizes that changes in the direction of the objectives stated must be made slowly and only where fishermen are ready for such action.

The Commission gave special attention to the rehabilitation of the U.S. fisheries, with a far-reaching recommendation that the new agency establish national priorities and policies for fishery development in cooperation with other federal, state, and interstate agencies. Their recommendation follows a strong criticism of the confusing patchwork of state laws and regulations. Further, the Commission recommends that, if necessary, the new agency should be given statutory authority to assume regulation of endangered fisheries. In proposing this measure, the Commission had in mind the precedent set by the Federal Water Pollution Control Act in which the federal agency sets policies and gives the states opportunity to adhere to those policies.

The Commission recommends that the present legal restrictions on the use of foreign-built vessels be removed.

The Commission recommends that specific plans be developed for expansion of fisheries where possible. The Commission also recommends greatly increased emphasis on assessing the location and size of the stocks of fish off our coasts and on technology basic to improvements in gear and fishing methods. The Commission discusses at some length the problems of producing and using fish protein concentrate and recommends expanded support for the program. I get the impression that there might have been the feeling that this program had been oversold.

With respect to international fisheries management, the Commission rejected giving each coastal nation exclusive access to the living resources over its continental shelf or giving the United Nations title to the living resources beyond the 12-mile limit. Instead, the Commission concluded that U.S. objectives can best be attained by improving and extending the existing international arrangements. It went on to suggest some ways in which these international arrangements should be extended, specifically with regard to fixing national quotas for cod and haddock fishing in the North Atlantic, and that consideration be given to national catch quotas for the high-seas fisheries of the North Pacific, an extension of the quota system which is already in effect for Fraser River salmon, fur seals, and king crab in the Bering Sea.

The Commission went on to make a number of recommendations to strengthen international fishery organizations. These are in the direction of considering ecological boundaries, in deciding on areas to be included in conventions, establishing conventions before fish stocks are depleted, gaining more adherents to the Convention on Fishing and Conservation of Living Resources of the High Seas, strengthening the scientific staffs and the enforcement programs of the international conventions, and strengthening the arbitration machinery.

I have the opinion that some of the recommendations about international fisheries bear on small parts of large complicated problems which the Commission did not investigate in sufficient depth. The recommendations cannot attract universal approval because of the various problems in different parts of our country. Their principal point of extending the existing framework of specific bilateral or multilateral agreements is, however, an approach that all U.S. fisheries interests can back.

With regard to aquaculture, the Commission looked through aqua-colored glasses which obscured the very difficult technical and economic problems involved. They did recommend strengthening the programs and removal of the legal and institutional barriers that inhibit aquaculture.

The Commission made many other recommendations that touch on fisheries matters, but the above are what I consider to be the more significant recommendations related to the fisheries of the Pacific Northwest. The most significant of all, however, is the proopsal to establish the agency, out of Interior, closer to the President, with much more weight in the government.

The move out of interior to an independent agency would remove fisheries from under about two layers of administrators who have scant knowledge of fisheries or international problems and who are under major political pressure to preserve the environment. The Secretary of the Interior, for example, has officially recognized an endangered species of birds but not the waste of a major fish resource through nonutilization.

The proposed new agency would be much larger and able to develop its whole program around clear and specific objectives related to the use of the oceans. The fish are our major oceanic resource and the fisheries a major reason for pub-

lic concern about the use of the sea. The case for increased support of the fisheries could be made more effectively in such an agency.

It is most important to note that the first question and the major question is whether to create this new agency. If it should be created, the numerous other recommendations would be considered during the development of programs and would still be subject to modification by Congress. If it should not be created, then the several programs concerned with the oceans would go their separate ways and be inadequately coordinated and without the strength to obtain the support the overall program needs.

STATE OF MISSISSIPPI,
EXECUTIVE DEPARTMENT,
Jackson, Miss., May 13, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, U.S. House of Representatives, Washington, D.C.

DEAR CONGRESSMAN: Pursuant to a statement by Congressman William M. Colmer before your subcommittee in session this week, I am submitting herewith my own statement supporting that of Mr. Colmer.

I would appreciate your entering these remarks and the attached Executive Order No. 45 into the documentary report of your subcommittee hearings.

Thanking you, and with warm personal regards, I am

Sincerely yours,

JOHN BELL WILLIAMS,
Governor.

STATEMENT BY HON. JOHN BELL WILLIAMS, GOVERNOR OF MISSISSIPPI

Mr. Chairman, the following statement is made in order to document the efforts by the State of Mississippi, to date, in the desire to further a Federal-State program in Oceanography.

All of the coastal and Great Lakes States are in accord in the recognition of the need for a strong Federal program by which the several states may formulate their own meaningful programs for national benefit. Mississippi recognized very early the impact of State planning for substantive formulation of Federal design. Federal guidelines have been designed by executive and legislative direction and the Marine Sciences Commission Report was completed and published early this year.

Mississippi, by its very nature geographically at the center of the Gulf Coast crescent, has fostered and will continue to develop a strong role in oceanic endeavor. A dramatic signal of State purpose was the announcement in 1967 that Mississippi would build the most modern shipyard in the world at Pascagoula, thereby, assisting the United States in regaining world stature it once held in this industry. The State of Mississippi, by special legislative action, demonstrated faith and endorsement of such a facility by the issuance of $130 million in bonds for construction of the huge installation. The shipyard, upon completion, will be leased to Litton Industries, Ingalls Shipbuilding Division for operation. Completion is scheduled for 1970 at which time the most mechanized assembly-line method of production coupled with advanced marine technology will be in support of national goals in ship construction. On May 2, 1969 it was announced that Ingalls had been awarded a $1 billion contract by the Navy for nine LHA all purpose assault ships.

Mississippi has two deep water ports: at Pascagoula, and at Gulfport which the state owns and operates. Gulfport presently represents a State investment of $10 million with a bond limitation of $25 million. Gulfport is the number one banana unloading facility on the Gulf Coast and the second largest in the United States. This is also the leading combined raw jute and cotton bagging center in the United States.

Four major Federal facilities enhance the position of Mississippi in the developing marine sciences. The NASA/Mississippi Test Facility at Bay St. Louis represents a Federal investment of over $400 million. This facility is already very much oriented toward the marine science field. Most notably and in fact presently in operation is BOMEX (Barbados Oceanographic and Meteorological Experiment) under the direction of ESSA (Environmental Science Services Administration), but jointly sponsored by several Federal agencies. The State of Mississippi has made available, to this project, the Gulfport harbor facilities for dockage

and warehousing requirements. The Mississippi Test Facility complex includes data acquisition capability, a test control center, rocket test stands, acoustic laboratories, a data handling center, an electronics and instrumentation center along with numerous office, administrative and support systems. Mississippi borders on the sea body which is one of the richest habitats of fish as well as the center of the greatest activity for offshore oil production in the world. Pascagoula is the location of the Exploratory Fishing and Gear Research Base of the Bureau of Commercial Fisheries. This base concerns itself with expanding present fishing grounds, locating new grounds and developing new harvesting and utilization techniques. Its research covers basic ocean engineering concepts and animal behavior, promising to lead to dramatic new harvesting techniques. Much of the direction of fishery development over the next decade will evolve from the activities now in progress at Pascagoula.

The Waterways Experiment Station of the U.S. Corps of Engineers at Vicksburg offers a tremendous facility for river, estuarian studies and water resource ecology. The Navy Seabee Base at Gulfport is a fine support facility for marine engineering and training for marine activities.

To further document the long term assessment of our nation's oceanographic goals, Mississippi took a positive and dramatic step this year. On April 10, 1969 I created the Mississippi Council for the Development of Marine Resources by executive order. This select body of academic, industrial and state leaders will evaluate consultant studies already completed and establish the programs to enhance and develop marine science programs in Mississippi over the next ten years.

To further document Mississippi's interest and direct purpose in oceanography Executive Order No. 45 describes and specifies the function and authority of the Mississippi Council for the Development of Marine Resources.

Thank you.

MISSISSIPPI EXECUTIVE DEPARTMENT, JACKSON

EXECUTIVE ORDER NO. 45

By virtue of the authority vested in me as Governor of the State of Mississippi, and pursuant to the Constitution and applicable statutes of the State of Mississippi, it is hereby ordered as follows:

1. There is hereby created and established within the Mississippi Agricultural and Industrial Board the Mississippi Council for the Development of Marine Resources until such time as enabling legislation is adopted to establish the Mississippi Council for the Development of Marine Resources.

2. Because of the existing and increasing opportunities to the State of Mississippi through participation in the field of Oceanographics, it is essential that an orderly and diligent study be made of what avenues are open to the people of Mississippi in their achievement of their goals in this field.

The purpose of this procedure is to provide for the rendering of mutual aid between educational institutions and the Marine Resources Council and with the Federal government with respect to providing suitable skilled professionals and labor in this area of development and the taking of such steps as necessary and appropriate to carry out the provisions of this Order.

It is further declared to be the purpose of this Order and the policy of the State that all present plans and future programs involving the field of marine sciences be coordinated with comparable functions of the Federal government, including its various departments, and agencies of other states and localities and all private agencies so that the most effective, efficient and economical participation by the State of Mississippi may be made in the field of marine resources.

3. The Executive Director of the Mississippi Agricultural and Industrial Board shall be the administrator of the Council.

Such technical, administrative, stenographic, clerical and other personnel in the employ of the Mississippi Agricultural and Industrial Board and compensated thereby shall be made available to the Council in the performance of its duties.

4. The members of the Mississippi Council for the Development of Marine Resources shall serve in an advisory capacity to the Governor and to the Mississippi Agricultural and Industrial Board.

They shall have such powers and responsibilities as may be designated by this Order. The Governor shall serve as Chairman of the Council; the Vice Chairman of the Council shall be appointed by the Governor; the following shall be members of the Council:

Governor John Bell Williams, chairman; James O. Cagle, Columbia, Pearl River Electric Power Association; A. F. Dantzler, Pascagoula, Dantzler Boat & Barge Company; William Dorsett, Biloxi, Manager, Broadwater Beach Hotel; Brad Dye, Jr., Jackson, Executive Director, Mississippi A & I Board; Robert B. Everett, Jackson, Chairman of the Board, Fox-Everett Insurance Comapny; F. M. Fortenberry, Jackson, Junior College Board; Porter Fortune, Oxford, Chancellor, University of Mississippi; Ellis B. Gardner, Pascagoula, President, Ingalls Shipbuildings Company; William Giles, Starkville, President, Mississippi State University; John K. Gresham, Greenville, Manager, WJPR; David Halbrook, Belzoni, Mississippi House of Representatives; Martin R. McLendon, Jackson, Assistant Attorney General, State of Mississippi; W. D. McCain, Hattiesburg, President, University of Southern Mississippi; John R. Picard, Pass Christian, General Manager, General Electric Support Department, Mississippi Test Facility; Ben Stone, Gulfport, Mississippi State Senate; E. E. Thrash, Jackson, Executive Secretary and Director, Board of Trustees, Institutions of Higher Learning; W. Calvin Wells, Jackson, Attorney, Research & Development Council Member.

The Governor may appoint in such numbers as he deems advisable additional members of the Council. Members of the Council other than State officials shall serve without compensation, but may be reimbursed for their reasonable and necessary expenses incurred in the performance of their duties.

5. The Council shall have the following duties, powers and responsibilities and others as deemed necessary by the Governor and the Mississippi Agricultural and Industrial Board:

a. To Coordinate the activities of all State boards, commissions, agencies, institutions and offices.

b. To advise departments, agencies, institutions, offices and subdivisions of State government thereof as it deems advisable.

c. To consolidate all efforts in the field of marine resources and the services of State departments, agencies, offices, institutions and subdivisions of State government so far as practical and to provide for their joint efforts.

d. To assume management of any available programs related to the Federal government in the field of marine resources.

e. To apply for, receive, hold and allocate and, if appropriate, to assist State departments, agencies, offices, institutions and political subdivisions of State government in applying for, receiving or holding such authorizations, licenses and grants as are necessary and proper to carry out the purposes of this Order.

f. To cooperate with the various agencies of the Federal government engaged in the programs involving marine resources, especially with the research facilities of the NASA-Mississippi Test Facility.

g. To study in detail and in depth the subject of Oceanography as it relates to the State of Mississippi and to report to the Governor the results and recommendations developed through the study.

6. It shall be the duty of every department, agency, office, institution and political subdivision of the State of Mississippi and the officers thereof to cooperate with and assist the Council in every reasonable way.

7. The Governor and the Council shall have general direction and control over the activities of the Council and shall be responsible for carrying out the provisions of this Order.

8. The Council is hereby authorized to receive services, gifts, contributions, property and equipment from public and private sources to be utilized in the carrying out of its functions.

9. The Governor, the Council and the Mississippi Agricultural and Industrial Board are authorized to enter into agreements with the Federal government for the purpose of realizing Mississippi's full potential in the area of marine resources.

In witness whereof, I have hereunto set my hand and caused the Great Seal of the State of Mississippi to be affixed. Done in the City of Jackson this 10th day of April, 1969.

[SEAL]

JOHN BELL WILLIAMS,
Governor.

EXECUTIVE MANSION, STATE OF MAINE,
May 12, 1969.

Hon. ALTON A. LENNON,
Oceanography Subcommittee, Merchant Marine and Fisheries Committee, U.S. House of Representatives, Washington, D.C.

DEAR CONGRESSMAN LENNON: Speaking for the State of Maine, with our traditional interest in the use of America's ocean resource, I most emphatically support the need for an independent agency at the Federal level to coordinate and lead an oceanographic program for the nation. Such an agency is needed to focus America's efforts in the proper exploration and exploitation of the marine world. Further, I support the concept of a National Advisory Committee on the Oceans, which would include representatives from the States.

It seems to me that America has lagged badly in these last few decades in our concern for the ocean. In many areas—fishing, aquaculture, merchant marine—we have fallen behind nations such as the Soviet Union and Japan. It has been particularly disturbing recently to see this lack of thrust in our oceanographic efforts begin to have an effect on our Naval superiority, resulting in over-aged fleets and a need for massive refurbishing of our surface and sub-surface Naval forces.

An independent oceanographic agency, preferably on the executive level, will help to correct this imbalance and will, I am sure, supply the dynamic impetus that is vital if America is to get moving in a meaningful way in the oceanographic field. I hope and trust your subcommittee will act favorably upon these recommendations.

Sincerely yours,

KENNETH M. CURTIS,
Governor.

EXECUTIVE DEPARTMENT,
Austin, Tex., June 4, 1969.

Hon. ALTON A. LENNON,
Chairman, Oceanography Subcommittee, Merchant Marine and Fisheries Committee, House of Representatives, Washington, D.C.

DEAR CONGRESSMAN LENNON: The Interagency Natural Resources Council has initiated a comprehensive Coastal Resources Plan of the Texas Gulf Coast to provide for the management and development of the human and natural resources of this urbanizing region. To continue this planning effort, the Texas Legislature has passed a Concurrent Resolution, S.C.R. 38, and I, as Chairman of the Council, have requested $200,000 in appropriations for the next biennium beginning on September 1, 1969.

The Division of Planning Coordination within my Office has reviewed and commented favorably on the report of the Commission on Marine Science, Engineering, and Resources, "Our Nation and the Sea." Thus, I support the creation of a National Oceanic and Atmospheric Agency at the Federal level and the establishment of a National Advisory Committee on the Oceans to include representatives of the States.

Texas has the opportunity to assume national leadership with its comprehensive coastal planning program, and I am looking forward to cooperating and working with you for the realization of this exciting potential. In addition, I am designating my Executive Assistant, Mr. Harold Dudley, to be the liaison contact with you in regards to my intention to faster a State-Federal partnership for marine resources development.

Sincerely,

PRESTON SMITH,
Governor of Texas.

EXECUTIVE CHAMBERS,
Honolulu, May 22, 1969.

HON. ALTON A. LENNON,
Chairman, Oceanography Subcommittee, Merchant Marine and Fisheries Committee, Rayburn House Office Building, Washington, D.C.

DEAR REPRESENTATIVE LENNON: Our position in mid-ocean requires constant awareness of the direction of the many Federal projects and programs in oceanography.

National programs in the marine sciences will continue to have significant influence on Hawaii's ocean-oriented community. We have carefully studied the report of the Commission on Marine Science, Engineering and Resources, "Our Nation and The Sea" and supports its recommendations to establish the National Oceanographic Atmospheric Agency and the National Committee on the oceans. We believe that in order to give ocean activities adequate focus and attention, they should be brought together under an independent agency.

We give our full support to the Commission's report.

Aloha, and may the Almighty be with you and yours always.

Sincerely,

JOHN A. BURNS,
Governor.

THE COMMONWEALTH OF MASSACHUSETTS,
EXECUTIVE DEPARTMENT,
Boston, June 20, 1969.

MR. RICHARD N. RIGBY, JR.,
Executive Director, National Oceanography Association, Washington, D.C.

DEAR MR. RIGBY: The Commonwealth of Massachusetts is indeed concerned with the Oceanography Subcommittee of the House Merchant Marine and Fisheries Comittee's hearings on America's ocean program. Since our earliest history, Massachusetts has had an important stake in marine resources and even today ranks among the top three states in the value of its fishery landings. Through its private, federal and state marine research facilities, the Commonwealth is in an enviable position to provide scientific support for any increased exploration or exploitation of the ocean's resources.

I endorse the concept of a new single ocean agency on the federal level since such a reorganization should provide for a greater effort in this field which is our last great frontier. I also feel strongly that as recommended in the Stratton report the capabilities of the states with regard to management of territorial waters should be strengthened by federal financial assistance.

Thank you for providing the opportunity for Massachusetts to contribute to this important issue.

Sincerely,

FRANCIS W. SARGENT, *Governor.*

STATE OF NEW HAMPSHIRE,
DEPARTMENT OF RESOURCES AND ECONOMIC DEVELOPMENT,
Concord, N.H., May 23, 1969.

HON. ALTON LENNON,
Chairman, Oceanography Subcommittee, Merchant Marine and Fisheries Committee, House of Representatives, Washington, D.C.

DEAR REPRESENTATIVE LENNON: I am advised that the Oceanography Subcommittee of the House Merchant Marine and Fisheries Committee is currently holding hearings on America's ocean program.

As chairman of the New Hampshire Advisory Council on Oceanography (a group of some 40 educators, industrialists and State officials appointed by the governor last year to develop a State ocean program), I wish to take this opportunity to register with your subcommittee our strong and enthusiastic support for establishment of an independent ocean agency within the Federal government, along lines recommended by the National Commission on Marine Science, Engineering and Resources.

It may interest your subcommittee to know that there is within the State of New Hampshire strong support for development of a State ocean program, prerequisite to New Hampshire's eventual participation in a regional oceanographic

effort. We believe that the program we have recommended to the governor and which is currently under legislative consideration, would be given added significance as well as considerable impetus by creation of a Federal ocean agency.

Sincerely,

R. J. CROWLEY, Jr.,
Commissioner.

UNIVERSITY OF MARYLAND,
College Park, Md., May 9, 1969.

Hon. ALTON A. LENNON,
Chairman, Subcommittee on Oceanography, U.S. House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: It is my understanding that your committee is now reviewing the recommendations of the Commission on Marine Science, Engineering and Resources. Permit me, in a personal capacity, to offer some comments.

The report "Our Nation and the Sea" is a monumental document. It is impressive in the depth of its reasoning and its broad scope. Of particular significance from a scientific point of view is the recognition that the earth's atmosphere and the ocean are a single system. Studies of this system and practical conclusions drawn from them will be of great importance to the nation and mankind.

Several recommendations of the Commission are particularly noteworthy. Among them is the suggestion to create a single major agency to pursue the national marine and atmospheric programs. This will serve to give orientation and the necessary push to these essential programs. This, together with the recommendations to establish university-operated national and coastal zone laboratories, would have a beneficial effect for both research and operational purposes.

Let me urge that your Committee weigh these recommendations favorably and initiate the necessary legislation to bring this forward-looking report to fruition.

Sincerely yours,

H. E. LANDSBERG, *Research Professor.*

STATE OF FLORIDA,
COMMISSION ON MARINE SCIENCES AND TECHNOLOGY,
Coral Gables, Fla., May 2, 1969.

Hon. ALTON LENNON,
U.S. Representative, State of North Carolina,
House Office Building, Washington, D.C.

DEAR MR. LENNON: This is to inform you that the Florida Commission on Marine Sciences and Technology has officially endorsed the report of the U.S. Commission on Marine Science, Engineering and Resources and respectfully urges that your subcommittee approve the recommendations contained therein. One of our Commissioners, John H. Perry, Jr., was a member of the U.S. Commission and we therefore have been very close to the preparation and documentation of the report.

Wishing you the best of luck with the current hearings, I am,

Yours sincerely,

JOHN LACERDA,
Executive Director.

THE AMERICAN LEGION,
Washington, D.C., May 26, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography, House Committee on Merchant Marine and Fisheries, Longworth House Office Building, Washington, D.C.

DEAR CHAIRMAN LENNON: Enclosed is a copy of Resolution No. 369, approved by the 1968 National Convention of The American Legion calling for nuclearization of all U.S. Navy oceanographic survey ships and an increase in all oceanographic efforts of the U.S. Navy.

I would appreciate your including Resolution No. 369 in the permanent record of the hearings presently being conducted by your Subcommittee.

The opportunity to submit this resolution to you for consideration is appreciated.

Sincerely yours,

HERALD E. STRINGER,
Director.

50TH NATIONAL CONVENTION OF THE AMERICAN LEGION HELD IN NEW ORLEANS, LA., SEPTEMBER 10–12, 1968

RESOLUTION NO. 369—COMMITTEE ON NAVAL AFFAIRS—SUBJECT, U.S. NAVY OCEANOGRAPHIC PROGRAM

Whereas, the oceans have been of strategic importance since the dawn of history and are becoming of increasing interest as the Navy's operating environment and as food and mineral sources; and

Whereas, the oceans belong to no one nation and are a great resource to be shared by all mankind; and

Whereas, Russia has a vigorous and substantial oceanographic program which is marked by increased research activities throughout the world, and ever increasing capabilities; and

Whereas, there is only one first-rate oceanographic fleet in the world, that of the Soviet Union; and

Whereas, it is considered most essential to our national security and economic interests to sponsor substantial oceanographic programs at ever increasing rates; and

Whereas, it is highly desirable for any U.S. Navy oceanographic survey and research ship to have unlimited range and staying power (as well as adequate research and support facilities) while conducting a scientific expedition; and

Whereas, nuclear propulsion will provide this staying power; and

Whereas, nuclear propulsion is in the last analysis cost comparative. Now, therefore, be it,

Resolved, by The American Legion in National Convention assembled in New Orleans, Louisiana, September 10, 11, 12, 1968, that we urge strong support of:

1. Nuclearization of all U.S. Navy oceanographic survey ships; and
2. An increase in all oceanographic efforts of the U.S. Navy.

NATIONAL FISHERIES INSTITUTE, INC.,
Washington, D.C., May 20, 1969.

Re Hearing on the Marine Science Commission Report.

The Honorable ALTON LENNON,
Chairman, Subcommittee on Oceanography,
House of Representatives Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: The work of the Commission on Marine Science, Engineering and Resources is of extreme interest and significance to the members of the National Fisheries Institute. The Institute is a trade association made up of companies engaged in the production, processing, and distribution of fish and seafood. Accordingly, our members are aware of the vast potential benefits of a well planned, effectively managed national oceanic policy.

The National Fisheries Institute agrees with and supports the basic concept advanced by the Commission, that of a single comprehensive oceanic agency, and acceleration of marine research funding.

To express this sentiment, the Institute's Board of Directors unanimously approved the attached resolution at its annual meeting April 19, 1969. We submit this for the record of the hearings now underway. At a later date in the hearings, the Institute may request the opportunity to present an oral statement.

Sincerely yours,

LEE J. WEDDIG,
Executive Director.

RESOLUTION ON REPORT OF THE COMMISSION ON MARINE SCIENCE, ENGINEERING AND RESOURCES

Whereas, the future security, economy, of the United States and its ability to meet increasing food demands depend greatly on its full and wise use of the sea, and

Whereas, the nation's comprehensive utilization of the oceans and their resources is dependent greatly upon organized government action, and

Whereas, the present federal organization has divided the nation's ocean activities among many departments; and

Whereas, the Commission on Marine Science, Engineering and Resources was established by Congress two years ago to determine a recommendation of a national ocean policy, and

Whereas, this Commission has issued a comprehensive series of recommendations that would provide organized development of a national oceanic effort under a single agency, and

Whereas, the interests of the fishing industry will be enhanced in an expanded, comprehensive oceans program, and

Whereas, certain of the Commission's minor recommendations may not be completely in accord with the best interests of the industry, therefore, be it

Resolved, That, the National Fisheries Institute support the general broad recommendation of the Commission that would establish a single, comprehensive agency to coordinate our nation's oceanic affairs; and be it further

Resolved, That, the Institute would consider on an individual basis secondary recommendations of the Commission as they come before Congress and the administrative agencies.

WASHINGTON, D.C., *May 22, 1969.*

Mr. JOHN M. DREWRY,
Chief Counsel, House Committee on Merchant Marine and Fisheries, 1334 Longworth House Office Building, Washington, D.C.

DEAR MR. DREWRY: I have read Prof. Bauer's statement a number of times and I am still uncertain as to the philosophical basis of his objection to N.O.A.A. In one part of his presentation he implies that we have bitten off more than the government can chew; nevertheless he winds up with a recommendation for creating a Department of Environmental Sciences which would indicate that we didn't go far enough. However, I will restrict my comments to a few of his points.

1. I quite agree with Prof. Bauer's statement that it is impossible in an ultimate sense, to separate "the atmosphere from the oceans or both from the land." But I believe that is a comment that can be made about the entire universe and that logically the planet Earth cannot be separated from the outermost reaches of the cosmos. This philosophical truth, however, must include the fact that arbitrary distinctions must be made if any part of the universe can be studied effectively, and those distinctions must be based on the state of human knowledge at any given time. It is the judgment of the Commission that the state of knowledge has reached the point where it would be useful to study the oceans and the atmosphere as a whole and we so recommend it. Unquestionably, a point will be reached down the road where it will be useful to study the atmosphere, the oceans, *and the land* as a whole but I believe that at this point in our history such an effort would merelly create an indigestible lump of knowledge. For the time being, the best we can hope for is an exchange of knowledge between those studying the atmosphere and the oceans and those studying the land mass.

2. Had the Commission recommended a fisheries agency, a pollution agency, or an undersea technology agency reporting directly to the President, Prof. Bauer's parallel to a cancer research agency would be apt. However, we did not do so. The agency that we proposed is sufficiently broad in scope to justify an official who can report directly to the President just as the Space Agency does.

3. I am not going to comment upon his remarks concerning the geological survey as I believe Prof. Bauer attaches a greater amount of importance to the issue than actually exists. But I certainly disagree with his conclusion that it is unrealistic to make N.O.A.A. the lead agency in geological surveys of the ocean bottom. It is true that the crust of the earth above and below the seas is continuous. But the techniques for studying the crust must differ in the two environments and it is obvious that those now engaged in a study of the crust have gained very little knowledge of the ocean floor. This knowledge will only be gained when its gathering becomes the responsibility of a marine-oriented organization.

4. I do not see any way in which the functions of the Bureau of Fisheries would be hampered by placing it in the new agency. The bilateral agreements with other agencies that he discusses could be conducted just as well through N.O.A.A. as through the Interior Department. But the fisheries functions would benefit from intellectual cross-fertilization with other marine-oriented disciplines.

5. I fail to follow the logic of his opposition to removing the Coast Guard from the Department of Transportation. The Coast Guard unquestionably has the greatest amount of physical resources available for oceanographic work and this is a capability we should not overlook. I believe that this would be far more important to the United States than granting the Coast Guard responsibility for operating and maintaining civilian vessels of the federal government.

6. The proposal to change the Interior Department into a Department of Environmental Sciences seems to me a genuine example of biting off more than can be chewed at the present time. Furthermore, Prof. Bauer only proposes to strengthen the Interior Department by giving it the Weather Bureau and the Coast and Geodetic Survey. Since he would not give it the Coast Guard (or presumably ESSA), he would not be granting it any real resources for oceanography. In other words, he would create an agency charged with a tremendous responsibility but lacking elementary tools to carry out the task.

I have not commented on all of Prof. Bauer's statements but only those which appear to me to require a reaction.

Sincerely yours,

GEORGE E. REEDY.

COMMENTS OF JOHN H. PERRY, JR., PRESIDENT, PERRY PUBLICATIONS, INC., ON STATEMENT BY PAUL S. BAUER, ADJUNCT PROFESSOR OF EARTH SCIENCE, THE AMERICAN UNIVERSITY, CONSULTING ENGINEER

When the Commission on Marine Science, Engineering, and Resources filed its report, "Our Nation and the Sea—A Plan for National Action", it anticipated that there would be tremendous opposition to the Commission's recommendations among those agencies whose present ocean roles and responsibilities would be reduced in favor of a strong centralized executive/administrative air and ocean environmental agency, identified by the Commission as the National Ocean and Atmosphere Agency. Professor Bauer's statement appears to be a manifestation of this anticipated opposition on behalf of the Department of Interior.

Professor Bauer raises what he terms a fundamental objection to the proposed organization of N.O.A.A. because "basically, any organization which desires to effectively study an environmental system, such as planet Earth, must consider the whole as well as its parts." He cites as an example the structure of our Continental shelves and slopes and says, "Studies of the Continental Shelf can not be interpreted without a consideration of the complete air, land and sea system."

Professor Bauer apparently has not read the Commission's report with care because it is in agreement with his views on the Continental Shelf studies. The Commission takes the position that as man's involvement with the ocean becomes more pressing, the more people and agencies become involved, the more scattered and fragmented become identifiable jurisdiction, authority and responsibility. This is as true in the Congress—with its proliferation of committees and subcommittees with an ocean or marine environmental interest—as it is within Washington's administrative structure. And it is precisely this that the Commission seeks to correct with the organization of N.O.A.A. It seeks to improve the capability for a proper study of all parts of our evironmental system by concentrating areas of effort and cooperation and eliminating duplication and overlapping.

Professor Bauer's objection that the creation of N.O.A.A. as an agency reporting directly to the President would eliminate any higher echelon of management which is concerned with the total environment is difficult to comprehend. This level would be top echelon. Does he envision an echelon higher than presidential level? If so, this is as illogical as his statement about a group of enthusiasts concerned with cancer research wanting a separate agency reporting directly to the President.

Professor Bauer's third objection that the creation of N.O.A.A. would result in the Interior Department being no longer concerned with the marine environment is not completely true. But even if it were, it would not be a bad situation. In the first place, the Interior Department, I am sure, has enough other activities to keep it and its personnel busy. Secondly, its present areas of concern with the marine environment are fragmented and no doubt overlap those of other agencies. So, actually it would be beneficial, as the Commission has proposed in its program, to eliminate this fragmentation and duplication.

Professor Bauer's statement that all of the current functions of the U.S. Geological Survey would be duplicated by the Coast and Geodetic Survey is not true. There is no need for this kind of duplication. Intelligent planning and cooperative effort is what is needed and it would be attained under the proposed functions of N.O.A.A. working with other government agencies. Many such cooperative arrangements now in existence could be continued under the new setup.

Professor Bauer's statement that to remove the Bureau of Commercial Fisheries from the Department of Interior would be "a disastrous backward step" is totally unrealistic. He points out that this Bureau has attained a posture of

excellence in conducting large scale surveys of the marine environment not only from studies of the populations in the ocean but also from the study of the parameters (physical and chemical and atmospheric) which contribute to the ecology of marine plants and animals. If it has been able to attain this measure of success as a fragmented part of the Department of the Interior, is it not logical to assume that it could achieve an even greater degree of excellence if it were functioning under a completely marine-oriented department?

Professor Bauer has made certain recommendations which he terms constructive alternates to the recommendation of the Commission which would establish N.O.A.A. I do not believe their merit is equal to that of the Commission's proposal. Also, I respectfully request that in studying them the Subcommittee bear in mind that the interrelationships in the Commission's program were thought out at great length and without any political ambitions or motives on the part of the Commission members.

NEW YORK, N.Y., *June 13, 1969.*

Mr. JOHN M. DREWRY,
Chief Counsel, House Committee on Merchant Marine and Fisheries, 1334 Longworth House Office Building, Washington, D.C.

DEAR MR. DREWRY: Your letter of May 12 asking for comments on the statement by Paul S. Bauer of American University arrived while I was in Europe.

Mr. Bauer's views are so diametrically opposed to the recommendations of the Commission that it is difficult to address them in detail. I can only say that I disagree with the entire thrust of his remarks.

I don't know Professor Bauer, but he seems to be strongly influenced by a prior attachment to the Department of Interior. My answer to his recommendation for continued reliance on the Department of Interior is to suggest that the Committee look at that Department's record of achievement in the oceans in the past rather than at their press releases of what they hope to be able to do in the future. The Department of Interior has done a great deal of good work on land and its constituency is primarily a land constituency. I see no reason to believe that the Department is in any way qualified by past performance or by inclination to do a better job in the future than they have in the past in the oceans.

To be quite candid I think there may be a tendency on the part of some of the Department's constituents, including some of my former colleagues in the oil industry and my current colleagues in the mining industry to continue to want to deal with Interior whose personnel they know rather than deal with a new agency whose personnel and focus might be quite different.

I am sorry that I did not reply earlier to your request and I hope that these comments may be useful in some way.

Sincerely,

CHARLES F. BAIRD.

GREAT LAKES RESEARCH DIVISION,
THE UNIVERSITY OF MICHIGAN,
Ann Arbor, Mich., May 28, 1969.

Congressman CHARLES A. MOSHER,
Longworth House Office Building,
Washington, D.C.

DEAR MR. MOSHER: Because of my long involvement and interest in Great Lakes research. I had hoped to make arrangements for a meeting with you in early June to discuss some Great Lakes problems of mutual interest. My schedule will not permit me to do this before early summer, but I will be in contact with your office for a later appointment.

I have studied with great interest the Report of the Commission on Marine Science, Engineering and Resources, and would like an opportunity to discuss some of its recommendations with you. My general reactions to the report are:

1. That an organization such as the National Oceanic and Atmospheric Agency or something comparable, through consolidation of existing agency efforts, is essential and urgently needed to effectively administer a national program in Marine Sciences.

Directing my thoughts specifically to the Great Lakes, I would like to point out that physically, the St. Lawrence Great Lakes drainage basin is one system, however, politically, it exhibits a pattern of fragmentation. This physiographic unit is shared by eight U.S. states and two Canadian provinces. Heads of these

political units speak only for their unit. There is no unified plan or approach for management, utilization, or the solution of common problems in this drainage basin. Within the United States eight or more federal agencies are charged with Great Lakes missions; each has carried out its mission in a commendable way, but none is concerned with the lakes as a complete system. Furthermore an International Joint Commission attempts to represent the combined interests of the United States and Canada, and it too has done a commendable job within the limits of its objectives. More recently, 1967, the Great Lakes Basin Commission has been established to coordinate the United States activities on the Great Lakes. Basically, there exists the technical and scientific knowledge, manpower and economic need for unified programs in pollution abatements, water resources management and regional planning of the Great Lakes drainage basin, but the administrative mechanism is fragmented or lacking. The fact that these programs are non-operative is of deep concern because decisions are made and priorities established in the absence of a unified or regional plan or an understanding of the Great Lakes as a total system.

2. The national programs and projects recommended by the Commission are pertinent, imaginative, and meaningful in respect to the establishment of an effective coordinated effort in Marine Sciences. The concepts involved should be carried out regardless of the administrative mechanism. Three concepts which I think are excellent as to their application to Great Lakes problems are: 1) university-national laboratories, 2) coastal zone laboratories, and 3) water quality restoration in the Great Lakes. These suggestions would supply the essential facilities, and continuity of financial support for an effective attack on the pressing Great Lakes problems.

3. Although the Great Lakes have been adequately included in the Commission's report, nevertheless I have concern that they may not be included in the action program to the same degree. Compared with the oceans they are very small in area and therefore may be slighted in the actual national program, but in terms of national economic importance they are highly significant. I hope this point is fully appreciated and properly represented in the policy making processes.

4. One of the Commission's justifications or arguments for a national effort in Marine Sciences is that of increasing the supply of protein to meet the needs of a rapidly growing world population. This approach essentially ignores the fact that food supply cannot keep abreast of unchecked population growth. I believe the answer to the world population problems is population control not more food. I feel the Commission has weakened its appeal by implying that the food resources of the sea will help solve world population problems. I favor harvesting food from the sea, but for other reasons.

5. In general the Commission has done a tremendous job of assembling and analyzing pertinent information on the Marine Sciences of the nation. The completeness and thoroughness of the report makes it an outstanding reference which is of great value to both scientist and policy makers.

Hopefully, I will have an opportunity to discuss these and other Marine Science matters with you in greater detail.

Sincerely,

DAVID C. CHANDLER, *Director.*

U.S. DEPARTMENT OF COMMERCE,
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION,
Rockville, Md., May 22, 1969.

MR. JOHN M. DREWRY,

Chief Counsel, House Committee on Merchant Marine and Fisheries, Longworth House Office Building, Washington, D.C.

DEAR MR. DREWRY: I wish to thank you for the opportunity you have afforded the former members of the Commission on Marine Science, Engineering and Resources to comment on the statement submitted by Paul S. Bauer to the hearings of the Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries. As I noted in my appearance before the Subcommittee last January, I have reserved my position on proposals for reorganization of the Federal Government, being a Government member of the Commission. I feel that at this time I must still reserve comment and defer to the other members of the Commission.

Sincerely yours,

ROBERT M. WHITE, *Administrator.*

EXECUTIVE OFFICE OF THE PRESIDENT,
NATIONAL COUNCIL ON MARINE RESOURCES,
AND ENGINEERING DEVELOPMENT,
Washington, D.C., May 16, 1969.

Mr. JOHN M. DREWRY,
Committee on Merchant Marine and Fisheries,
Longworth House Office Building, Washington, D.C.

DEAR MR. DREWRY: Thank you for sending me Paul S. Bauer's comments on the COMSER report.

Mr. Bauer's recommendations deserve serious consideration. However, my present employment with the Marine Sciences Council Staff makes it inappropriate for me to provide detailed comments concerning his statement.

Sincerely,

DAVID A. ADAMS.

THE TEXAS A&M UNIVERSITY SYSTEM,
College Station, Tex., March 15, 1699.

President RICHARD M. NIXON,
The White House,
Washington, D.C.

DEAR MR. PRESIDENT: The Commission on Marine Science, Engineering, and Resources, in its report, *Our Nation and the Sea*, has proposed reorganization of some executive departments to meet the needs and challenges facing our nation relative to marine resources, and national decisions on this question will have a significant effect on our future. It is important that the question be viewed in a context which encompasses not only oceanic, atmospheric and coastal zone affairs, as suggested by the Commission, but which also includes environmental affairs. I propose to you such a comprehensive reorganization context.

Now is the time to make a broad and courageous step to consolidate and focus the federal executive concerns for natural resources and environments—a step similar to that which was taken when the Department of Defense was formed to consolidate concerns for national security. Specifically, I propose that there be created a Department of Natural Resources and Environments, made up of the Department of the Interior, the Department of Agriculture, and a new Department of the Oceans and Atmosphere. The relationships among these units would be comparable to the relationships among the Departments of Defense, Army, Navy, and Air Force. Bureau reorganizations can take place after the Department of Natural Resources and Environments has been formed.

The principal goal to be achieved is to replace the multi-agency program formulation and decision making on natural resources and environmental quality with a unified major agency focus under one Secretary. Consequently, other units of the federal executive, for example, the Atomic Energy Commission, also might be brought within this new Department as appropriate. Within this major agency, consideration could be given to administrative arrangements that have been shown to be successful within the Defense Department. For example, a parallel to the Director of Defense Research and Engineering would be a Director of Environmental Research and Engineering.

My suggestion is made with the thought that future developments will bring about eventual consolidation of executive departments into a half dozen or so major departments concerned with segments of our national goals; i.e., Defense, State, Natural Resources, Human Resources, Technology and Industry, Communcation and Transport, and Governmental Affairs. It is too much to hope that such a comprehensive, reorganization will be done in one fell swoop. The Defense components were focused following our experiences of World War II, but only after much debate. Our nations growing complexity with the multiplicity of decisions on environmental and resource problems makes this an appropriate time for a second bold consolidation.

In your deliberations for implementing the recommendations made by the Commission on Marine Science, Engineering, and Resources, I urge consideration of this more comprehensive reorganization.

Respectfully yours,

JOHN C. CALHOUN, JR.

Appendix A

The following letter sent to Secretary Stans, also was sent to the people listed immediately following this letter. Replies received follow thereafter.

April 25, 1969.

Hon. Maurice H. Stans,
Secretary of Commerce,
Department of Commerce,
Washington, D.C.

Dear Mr. Secretary: This will refer to the recent report of the Commission on Marine Science, Engineering and Resources entitled "Our Nation and the Sea", which was forwarded to the President and the Congress on January 9, 1969. The Commission report was produced and released pursuant to section 5(h) of the Marine Resources and Engineering Development Act of 1966 (Public Law 89–454, 89th Congress, June 17, 1966). Your familiarity with the background legislation and the report is such that I am sure no further elaboration is necessary.

The report, as you know, covers a wide range of matters relating to our effort to establish an effective and enduring long-range National Program in all aspects of marine science affairs. Our Subcommittee on Oceanography and our Full Committee have dealt at length with the subjects covered by the Commission's report for the past ten years. The report brings into focus the many problems which we have already considered and raises many more.

Our Subcommittee on Oceanography is beginning an initial series of hearings on the Commission's report next Tuesday, April 29. Subsequent meeting dates for the initial series of hearings are scheduled for May 6, 7 and 8, May 13, 14 and 15, and May 20, 21, 22.

It is our intention to devote the currently scheduled hearings to testimony from institutions, industry, States, etc. Hopefully, soon after the first of June, we will be able to call upon the concerned Federal Government departments and agencies to present testimony covering their views on the many aspects of the report.

In the meantime, I would appreciate hearing from you concerning your general views on the report and an indication of the time period that you might be available to present testimony to the Subcommittee.

Our Committee staff will keep in touch with you as we develop our hearing program.

For your information, H.R. 8794, a bill to amend the Marine Resources and Engineering Development Act of 1966 to continue the National Council on Marine Resources and Engineering Development, and for other purposes, has been reported by the Committee and passed the House on Monday, April 21. Under this bill the life of the Council would be extended one year to June 30, 1970.

Sincerely,

Alton Lennon,
Chairman, Subcommittee on Oceanography.

Identical letter to.—Honorable William P. Rogers, The Secretary of State; Honorable Robert P. Mayo, Director, Bureau of the Budget; Dr. Edward Wenk, Executive Secretary, National Council on Marine Resources & Engineering Development; Dr. Lee A. DuBridge, Director, Office of Science & Technology; Dr. S. Dillon Ripley, Secretary, Smithsonian Institution; Dr. Glenn T. Seaborg, Chairman, Atomic Energy Commission; Honorable Walter J. Hickel, Secretary of the Interior; Honorable Melvin R. Laird, Secretary of Defense; Honorable Maurice H. Stans, Secretary of Commerce; Honorable John A. Volpe, Secretary of Transportation; Dr. Leland J. Haworth, Director, National Science Foundation; Dr. John C. Calhoun, Jr., Chairman, Committee on Oceanography, National Academy of Sciences; Lt. Gen. Wm. F. Cassidy, Chief of Engineers, Department of the Army; and Honorable Robert H. Finch, Secretary of Health, Education, and Welfare.

THE SECRETARY OF COMMERCE,
Washington, D.C., May 8, 1969.

HON. ALTON LENNON,
Chairman, Subcommittee on Oceanography, House of Representatives, Washington, D.C.

DEAR MR. LENNON: Thank you for your letter of April 25, 1969, inviting me to appear before your Subcommittee and present the views of the Department of Commerce on the report of the Commission on Marine Science, Engineering, and Resources. The Department of Commerce will be pleased to testify on June 13, which has been previously arranged by our staffs.

We have read and analyzed this challenging report and have found it to be stimulating and innovative. In our opinion, it provides an excellent basis for the formulation of a vigorous and far-reaching national effort with enormous implications for this country's social and economic welfare. My staff and I are prepared and welcome this opportunity to discuss and elaborate upon our views of the report with you.

Sincerely,

MAURICE H. STANS,
Secretary of Commerce.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., June 6, 1969.

HON. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, House of Representatives, Washington, D.C.

DEAR MR. LENNON: This is in response to your April 25, 1969, letter requesting general views on the report of the Commission on Marine Science, Engineering, and Resources and an indication of the time period when a Bureau representative would be available to present testimony on the report to the Subcommittee.

Following an initial review of the Marine Commission's report by the Vice President in his capacity as Chairman of the Marine Council, the President's Science Adviser, and agencies concerned, the President has indicated that:

1. He expects agencies to take the Commission's recommendations into account in considering their programs and priorities in fiscal year 1971, and beyond.

2. The Marine Council should continue to review the Commission's recommendations for marine science programs and encourage further improvements in the coordination of Federal activities.

3. He expects his Science Adviser to consider the Commission's recommendations in relation to other scientific and technological activities and work closely with the Council.

The President has also asked Mr. Roy Ash, Chairman of the newly established Advisory Council on Executive Organization, to place high on the Council's agenda of matters to be studied the Commission's proposal for the creation of a new independent oceanic and atmospheric agency. In his request to Mr. Ash, the President asked that the Commission's proposal be examined carefully in the context of broader Federal organizational requirements. He further asked that the Council particularly consider related environmental and natural resource problems and compare the Commission's proposals with alternative ways of coordinating and advancing national development of the marine sciences.

The President has emphasized that the steps outlined reflect the intention of this Administration to assure full consideration of the opportunities in the oceans and to assess the Commission's proposals carefully in the context of national needs and priorities.

We understand that your Subcommittee will be hearing testimony from the Director of the Office of Science and Technology and from principal agencies concerned with recommendations made by the Commission. We believe these hearings are an excellent way of highlighting the important contribution made by the Marine Commission and an appropriate means of providing an opportunity for public witnesses and representatives of agencies affected to comment on the program and organizational recommendations.

We are, of course, very interested in the Commission's organization and program recommendations. Regarding testimony by the Bureau, however, we believe it unlikely that we could contribute information for the Subcommittee's consideration on program recommendations beyond that provided by the interested agencies and the Director of the Office of Science and Technology. In addition, in

view of the study assignment to the Advisory Council on Executive Organization, we would not be in a position to comment substantively on the Commission's reorganization proposals.

In light of these considerations, therefore, we would prefer not to testify at this time.

Sincerely,

ROBERT P. MAYO,
Director.

NATIONAL SCIENCE FOUNDATION,
OFFICE OF THE DIRECTOR,
Washington, D.C., June 4, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, House of Representatives, Washington, D.C.

DEAR MR. LENNON: This letter is in response to your letter to me of April 25, 1969, in which you requested my general views on the recent Report of the Commission on Marine Science, Engineering and Resources entitled "Our Nation and the Sea," and in which you requested an indication of the time period during which I might be available to present testimony to the Subcommittee. I would be pleased to testify before your Subcommittee and express my views and recommendations on those items of key interest in this Report. As a member of the Marine Sciences Council and as Director of the National Science Foundation I have studied the Report carefully and have asked the Foundation's staff to study it, with particular reference to the important responsibilities of this agency in increasing our national capability in marine science, technology and education.

I have a great deal of admiration for the painstaking, thoughtful and selfless efforts of the Commission and its staff. The extreme depth and detail of the Report require that it be given careful study, a study that will take considerable time since the Commission Panel reports have just been received and are in the process of being analyzed. We concur with several of the Commission's recommendations regarding the augmentation of existing programs and initiation of new ones. I believe that the cognizant agencies should move as rapidly as possible to carry out the national oceanographic effort without awaiting the longer term decisions and actions that should be made before any Federal reorganization. The Foundation is ready to do its part in this regard and is taking steps, within available funds, to implement those recommendations that fall within its purview and responsibility.

In regard to the recommendation of the report concerning the establishment of an independent agency, I believe various facets of the problem need further study. The argument that marine programs in non-mission agencies or agencies that traditionally have a land mission often receive less attention than warranted and relatively low priority from their administrators is demonstrable; however, these shortcomings could be corrected easily through assignment of higher priority to marine programs by the Executive and the Congress. Moreover, we do not believe that the problems related to integrated planning and coordination required within such a large and complex agency have been fully addressed.

While one of the most persuasive arguments for an independent agency is that a high priority for a national ocean program must have adequate coherence and balance to develop a constituency and to be of sufficient size to command an adequate share of the Federal budget, this must be weighed against the adverse effects upon the overall missions of agencies consequent to the removal of marine elements. Moerover, we believe that judgments on this whole matter must await the thorough consideration now being given by the Administration to the Report of the Commission on Marine Science, Engineering and Resources. This consideration must take place in the context of other concerns relating to the Federal Government organization in the general spheres of the environment, the natural resources, and science and technology, and, indeed, in the context of government organization as a whole.

Since the Commission Report is now under study by the Administration, I believe it is premature to express my conclusions at the present time. Insofar as a time period for testifying before your Subcommittee is concerned, I will be available during any mutually convenient time during the month of June.

Sincerely yours,

LELAND J. HAWORTH,
Director.

DEPARTMENT OF STATE,
Washington, D.C., May 8, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography, Committee on Merchant Marine and Fisheries, House of Representatives.

DEAR MR. CHAIRMAN: The Secretary has asked that I reply to your letter of April 25. I read with great interest of the plans of your Subcommittee on Oceanography for an extensive series of hearings with regard to the report of the Commission on Marine Science, Engineering and Resources.

We believe this report merits the very thorough consideration which you are planning to give it. We note that during the month of May you intend to devote hearings to testimony from various private groups and States and that after June 1 you hope to call upon the concerned Federal Government departments and agencies to present their views on the report. I can assure you we would be pleased to have an opportunity to discuss the report with the Committee and present our views.

As I believe you know, we have been engaged within the Executive Branch in a careful review of many aspects of U.S. policy relating to the seabed; this process is continuing. Department witnesses expect to be prepared to testify before your Subcommittee in early June when you begin to receive testimony from Federal Government departments.

Thank you for informing us that HR 8794, extending the life of the National Council on Marine Resources and Engineering Development by one year, has been reported by the Committee and passed by the House. The Council has fulfilled important functions with regard to international marine science affairs.

If I can be of assistance at any time, please do not hesitate to let me know.

Sincerely yours,

WILLIAM B. MACOMBER, Jr.,
Assistant Secretary for Congressional Relations.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., May 15, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography Committee on Merchant Marine and Fisheries, House of Representatives.

DEAR MR. LENNON: Your letter of April 25, 1969, requests my views on the recommendations in the recent report of the Commission of Marine Science, Engineering and Resources, entitled "Our Nation and the Sea."

Although I could present oral testimony on the recommendations of the report some time during the latter half of June if this is required, I believe I could adequately cover the specific recommendations which bear directly on AEC programs (thermal pollution legislation, submerged nuclear power plants and the development of power systems) in a written statement.

Please let me know if you would like me to prepare such a statement for the record of your hearings.

Cordially,

GLENN T. SEABORG.

EXECUTIVE OFFICE OF THE PRESIDENT,
NATIONAL COUNCIL ON MARINE RESOURCES
AND ENGINEERING DEVELOPMENT,
Washington, May 6, 1969.

Hon. ALTON LENNON,
U.S. House of Representatives,
Washington, D.C.

DEAR MR. LENNON: This is to acknowledge receipt of your letter of April 25, 1969 requesting my general views and future appearance before your Subcommittee on the Report of the Commission on Marine Science, Engineering and Resources. I will be available to appear before your Committee around the middle of June.

Sincerely,

EDWARD WENK, Jr.

THE ASSISTANT SECRETARY OF THE NAVY,
RESEARCH AND DEVELOPMENT,
Washington, D.C., May 9, 1969.

DEAR MR. LENNON: Mr. Laird has asked me to reply to your letter of 25 April. This letter dealt with your plan to hold hearings on the Report of the Commission on Marine Science, Engineering and Resources entitled "Our Nation and the Sea."

I will be pleased to appear before your committee to testify on the report. It is expected that I will be available during the months of June and July, which should be compatible with your general plan.

Attached are my general views on the Commission report. Only the issues that affect DOD in a major way are addressed in the paper, but I will be pleased to explain my position on other aspects of the report during my appearance.

The U.S. Army Corps of Engineers presents a unique situation with regard to their civil functions. Because of this aspect, I strongly recommend that you consider scheduling the Chief of Engineers, U.S. Army, to present his views on the Commission report.

Sincerely,

ROBERT A. FROSCH.

MARINE SCIENCE COMMISSION REPORT

The Commission report represents a careful and responsible analysis of the civilian-oriented portion of the national program, and it makes a number of valuable detailed recommendations. The ideas put forward are imaginative and useful in stimulating a great deal of new thought about various possibilities.

As the Commission states in its report, it did not specifically examine the national security aspects of marine matters, nor does it comment on these programs as such, other than endorsing and emphasizing the importance of the Navy's research and development in this area to its operations, and noting the importance of continuing this work. I concur in this view and it is my intention to continue these programs and to strengthen them in appropriate areas as noted in the Commission report. It should be emphasized that our national security is heavily dependent on the marine environment and that civil programs will interface significantly in this environment with the military operations and resources.

The general tenor of the report is that military and civil functions in the ocean should be coordinated but separated. I concur in this concept, but wish to note explicitly the importance that "spin-offs" from Navy technological programs have had for the development of the civilian side of national marine science development. It is my hope that coordination and cooperation between the military mission and civil oriented portions of the national program will continue to make this possible. It is certainly desirable.

Since the National Security Program is not directly discussed, the main issues of DOD concern deal with the interactions of DOD programs (including the major civil responsibilities of the U.S. Army Corps of Engineers) and civilian programs as these may be affected by the organization of the civilian side, and with the effect of proposed legal regimes on national security matters.

The Navy has played a major role in building the marine science resources of the country by supporting research programs in universities and research institutions. Our requirement for this kind of research support as background to our mission oriented programs continues and, in fact, is increasing. The DOD wishes to continue to supply a major portion of the support for large marine institutions (the University/National Laboratories) since we believe that only thus can we maintain a strong contact with these civil institutions and obtain the kind of research results necessary in the subject areas peculiar to our concerns. I believe that our support dovetails well with the proposed NSF and NOAA support of these areas. As in the past, the major agencies involved (principally Office of Naval Reesarch, National Science Foundation, and now, perhaps, NOAA) can work together to support a well integrated national research program in marine sciences.

As regards possible organizational modes for the civil side, the proposed establishment of NOAA and NACO must both be considered. It seems clear that some form of consolidation of marine functions leading to a somewhat smaller group of federal organizations with major interests in the field would be highly advantageous to the national program, both from the point of view of coordination and

of critical size of the elements. Thus the idea of NOAA is attractive. However, I see several problems that need to be considered in determining the final form of the organization.

The Commission report discussion of the proposed incorporation of the Coast Guard in NOAA refers to, but does not deal adequately with, the question of its continuation as a specifically identified armed force of the United States, to function as a component of the Department of the Navy in a national security role in time of war. Maintenance of this identity would somewhat detract from the advantages of consolidation of the Coast Guard with the other fleet operating entities (ESSA and BCF) to be joined with it in NOAA. The Commission report also does not take sufficient account of the large proportion of the Coast Guard's work occupied with search and rescue, and with marine safety matters not closely allied to the other functions assigned to NOAA, and the effect of this rather separate work on its participation in the main stream purposes of the agency.

It also seems clear that the large number of functions assigned to NOAA will require more resources than will be brought to it by the organizations that will come together to form it initially. The matter of additional staff strengthening is not addressed adequately in the Commission report. It is probable that a natural recruiting ground for initial staff augmentation might be from the Navy program, particularly in the area of ocean engineering and technology. Some such assistance to founding the civilian program in this field might well be wise, but unless carefully thought out and accomplished, the result might really be to cripple a Navy program that the Commission wants preserved, rather than to increase the national program and capability. This point should be examined carefully in the light of our earlier comments on the usefulness of Navy technological programs and the need for Navy research programs in this field, and the necessary detailed planning to avoid unnecessary difficulties accomplished before proceeding with NOAA.

The relationships between the DOD program and that of NOAA would need to be carefully coordinated both to prevent unnecessary duplication and to insure that the existence of either program could not be used as an excuse to cut the other unwisely.

The form in which NACO is proposed seems to us to be unwise on several counts. The mechanism suggested would appear to put one operating agency (NOAA) and what amounts to its advisory group (NACO) in an effectively controlling position over other operating agencies with their own special mission requirements. This nearly guarantees petty conflict arising from the natural tendency of NACO to regard NOAA jobs as more important than those of other agencies. It would seem preferable to use a management body composed of suitable representatives from the concerned organizations at, say, the Assistant Secretary level, with a group of outside advisors working with them. These groups might work throughout the year, but report to a more senior policy group like the present council, meeting annually to review the subject and report to the President. An alternative to a special senior policy group for annual review would be an annual review by the Federal Council on Science and Technology.

None of these organizational schemes is perfect, and all seem somewhat cumbersome, but the organization of a field that is principally defined by an environmental subject and area (although it does include some specific missions in it) in a government that otherwise tends to be principally functional and mission oriented cannot be easy. It might also be noted that establishment of another independent agency reporting to the President may not be entirely wise. However, there are legitimate objections to the subordination of NOAA to any of the existing departments.

At least until the establishment of the new organization proposed by the Commission, or such other new organization, I support the continuation of the National Council on Marine Resources and Engineering Development. As indicated in a previous paragraph, some alternative organizational schemes would also benefit by continued existence of this Council in some form.

The proposed University/National Laboratory System and the National Projects would form a comprehensive set of organizations and programs which could serve to stimulate the whole field. Establishment of the University/National Laboratories, however, should not be used to prevent or to make impossible forever the entry of major new organizations to the field, since the formation of new groups is frequently a powerful stimulus to progress. The consideration implies the necessity for and importance of the availability of support to research and development entities other than University/National Laboratories.

The National Projects themselves are interesting and would certainly stimulate further progress. It must be recognized, however, that some of them are already underway in several forms and to various degrees and thus the selection of what to do next must take detailed account of the current status. This matter is incompletely treated in the Commission report. In addition, before proceeding, a careful reexaminaion of the costs to be expected for the various projects should be undertaken since the Commission's costing was admittedly crude, as it had to be considering the dimensions of their task and the time and staff available. If NOAA is established, these tasks would be a proper part of its initial program. Otherwise, special studies would need to be undertaken so that the National Council on Marine Resources and Engineering Development could advise the President and guide the various agencies in proceeding with the National Projects.

As for the international legal/political framework for seabed resources, the DOD position stated in the letter of 6 January 1969 from Secretary Nitze to Secretary Rusk on the breadth of the continental shelf, and reaffirmed in the 6 March 1969 letter from Secretary Packard to Secretary Rogers, is pertinent. Briefly, our view is the following. First, a continental shelf regime limited to the 200 meter isobath coupled with a clear affirmation of the continued freedom of the superjacent waters and air space beyond the limit of the territorial sea would be the most compatible with our national security interests. If other U.S. government departments and users propose limits to the continental shelf beyond the 200 meter depth curve, they should be asked to demonstrate that these overriding interests and activities will generate real values that would be unobtainable to the nation without some wider limit. The interests of the United States would be best served if the territorial seas and straits questions were settled before any international agreement is reached on defining the outer limit of the continental shelf.

As indicated in the above paragraph, I attach great importance to the settlement of the territorial sea question prior to submitting any initiative on the seabed problem. The main reason is because the limited jurisdiction of the coastal states, insofar as seabeds are concerned, might be extended unilaterally to include other rights if there is no firm prior international agreement on the extent of total sovereignty.

In consonance with this quoted position, I generally support the rationale contained in pages 141–157 of the Commission report and consider the detailed recommendations worthy of further study. However, no national decision should be made on such matters without full consideration of the vital national security interests which could be significantly affected by them. The important caveat represented by the Commission's qualifications on page 147 must be emphasized and is quoted as follows:

"We also would like to stress that our major recommendations are interrelated. Rejection of any one of these recommendations would raise serious questions in the minds of the Commission as to the advisability of continuing with the others."

It should also be noted that I continue to support strongly the position developed in the Committee on International Policy in the Marine Environment to the effect that the most important immediate task is the general international acceptance of a moratorium on further claims of sovereignty and jurisdiction until the whole set of questions on regimes can be adequately studied and negotiated against a background of fact. Exploration and exploitation at all depths should continue, with the agreement that these activities would not be considered as prejudicing the determination of the regime. Existing exploitation should be considered as either exceptions to the regime, or treated by compensation, in the event that the regime excludes them.

MAY 28, 1969.

Hon. ALTON LENNON,
Chairman, Subcommittee on Oceanography,
House of Representatives, Washington, D.C.

DEAR MR. LENNON: In response to your letter of May 20, 1969, the U.S. Army Corps of Engineers will be pleased to testify before your Subcommittee concerning the report of the Commission on Marine Science, Engineering and Resources, entitled, "Our Nation and the Sea." Either I or key members of my staff will be available for this purpose at your convenience.

The Corps of Engineers has major and continuing interests in the coastal portion of the marine environment. The Corps involvement in the coastal zone,

and the Great Lakes, goes back to the earliest days of the Republic, starting with coastal fortification, construction of piers and seawalls, removal of obstructions to navigation, protection of islands and beaches, and deepening and maintaining harbors and tidal watercourses. Ove the years, the Congress has charged the Corps with ever-widening responsibilities in the coastal zone.

The Corps principal responsibilities today may be categorized as: (1) granting permits to see that the public interest is protected in all construction activities in navigable waters and (2) planning, designing, constructing, operating and maintaining engineering works in the coastal waters and in the Great Lakes. These engineering works include harbors, Great Lakes waterways, intra-coastal waterways, interoceanic canals, hurricane barriers, shore stabilization works, and the restoration of eroded beaches and shores.

I was favorably impressed by the magnitude and breadth of the Commission's report. It is indeed bringing into focus many of the most important aspects of our Nation's current and future involvement with the marine environment.

I agree with the Commission on the great importance of Federal-State and interagency coordination and cooperation in the coastal zone and have long emphasized this aspect of our responsibilities.

With the States, we have enjoyed a mutually-beneficial relationship. As you know, it has been longstanding Army policy not to grant a permit to any private interest if the State objects and to recommend a project only if it has been approved by the State concerned. At the formative stage we, along with many other Federal agencies, participate jointly with the States in the major, long-range, comprehensive, Federal-State, interagency planning program of the Water Resources Council for the Nation's water resources, both coastal and non-coastal. The Army is also the Chairman of the Comprehensive, Federal-State, Chesapeake Bay Study and a key member in each of the Federal-State river basin commissions, now existing in 15 of the 30 coastal states. We also had membership in the landmark San Francisco Bay Conservation and Development Commission and numerous other Federal-State groups.

Within the Federal Government, the Army has established formal means of coordinating with the most concerned Federal agencies before any decision on permits is made. In addition to the extensive interagency coordination required in the normal course of business, the Army has also been a key participant in the coastal aspects of the Marine Council's activities. Similarly, the Army regularly participates in the interagency deliberations of the Water Resources Council which seek to insure that the inland and coastal water resource activities of the Federal Government are appropriately interrelated.

We look forward to continuing this role of cooperation and coordination within the Federal Government and with the States.

Sincerely yours,

WILLIAM F. CASSIDY,
Lieutenant General, U.S. Army,
Chief of Engineers.

NATIONAL ACADEMY OF SCIENCES,
NATIONAL RESEARCH COUNCIL,
COMMITTEE ON OCEANOGRAPHY,
Washington, D.C., May 13, 1969.

Hon. ALTON A. LENNON,
U.S. House of Representatives, Rayburn House Office Building,
Washington, D.C.

DEAR MR. LENNON: The Committee on Oceanography is pleased to respond to your letter of 25 April asking for our views on the recent Report of the Commission on Marine Science, Engineering and Resources. We have discussed the Commission's Report, "Our Nation and the Sea" extensively at our January and March meetings. Our preliminary statement, based on these discussions, follows. As the Panel reports of the Commission become available, we will continue our review of the Commission Report and will look forward to the opportunity to comment in detail when public hearings are held by your Committee.

The Commission on Marine Science, Engineering and Resources has produced a milestone report. The Committee on Oceanography concurs in the Commission's conclusion that:

"How fully and wisely the United States uses the Sea in the decades ahead will affect profoundly its security, its economy, its ability to meet increasing demands for foods and raw materials, its position and influence in the world community and the quality of the environment in which its people live."

We applaud the recommended national marine program of the Commission as a major contribution and believe that national science needs will be well served by this program.

The single most important recommendation of the Commission is that the national marine program requires a major reorganization within the Federal Government, a point also stressed in our report "Oceanography 1966, Achievements and Opportunities." We believe that a single agency, or its equivalent, would provide the needed focal point for the development of capabilities that are essential to meet national needs recognized by the Commission. In our opinion many of the activities essential to an expanding program are unlikely to be adequately carried out in the framework of the shared agency responsibility.

Although the details of reorganization and the scope of activities for the proposed new agency will require much study and negotiation, we support the Commission recommendation that efforts in this direction proceed without delay. Furthermore, we urge the Congress to give early consideration to this proposal of the Commission.

As reorganization is discussed and as elements of the national marine program are considered in depth, many details and differences of opinion will need to be considered. The Committee on Oceanography recognizes the importance of continuing review and discussion, but strongly expresses the hope that such debate will not obscure the main thrust of the Commission's recommendations.

The program recommended by the Commission requires both an adequate technology and a firm scientific basis. In spite of the vigorous growth and development in the marine sciences and technology over the past few decades, the fact remains that our knowledge of the oceans and the factors that control its living and nonliving resources are just beyond the exploratory stage. Effective exploitation of the oceans' resources requires knowledge that can answer the fundamental questions of "where", "how", "why", and for certain resources, "when". At present our ability to monitor the oceans is limited by technology, our hopes to improve the ocean environment as well as our ability to predict changes in the oceans is limited by the progress of science. To achieve capabilities beyond these limits our nation will require an organization and a program such as is recommended in the Commission Report.

Specifically, the Committee on Oceanography believes that the following major recommendations of the Commission will do much to accomplish these goals:

(1) Establish increased understanding of the planetary oceans as a major goal (page 23)
(2) Establish university-national laboratories (page 27)
(3) Establish coastal zone laboratories (page 29)
(4) Initiate a comprehensive fundamental technology program (page 27)
(5) Establish national projects (page 37)
(6) Sea Grant Program expansion (page 44)

I hope these comments are helpful, and will be pleased to provide additional elaboration at a later date.

Sincerely yours,

JOHN C. CALHOUN, Jr.,
Chairman.

(Whereupon, at 12:05 p.m., the subcommittee adjourned, to reconvene at the call of the Chair.)

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